Materials Education SYMPOSIA

13th International Materials Education Symposium

Clare College, University of Cambridge
Cambridge, UK

April 4-5, 2024

This symposium is jointly coordinated by

Ansys & UNIVERSITY OF CAMBRIDGE

We are grateful for the help and advice of the Symposium Academic Advisory Committee

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Program-At-A-Glance

Section 1: Agenda

TIME	EVENT	VENUE
Wednesday, April 3rd: Workshops & Presenters' Dinner		
12:00-1:00pm	Registration Opens and Lunch	At workshop venue
1:00-5:00pm	Materials Science and Engineering in Ansys Granta EduPack& a Chat with Mike Ashby	Department of Materials Science and Metallurgy, University of Cambridge
1:00-5:00pm	Sustainability in Structural Simulation: Engaging Students with Ansys	
1:00-5:00pm	Department tour & a Chat with Mike Ashby	
7:00 PM	Presenters' Dinner *by invitation only*	St. Catharine's College
Thursday, April 4: Symposium Day One		
8:00am	Registration opens*	Clare College Gillespie Centre, Memorial Court
8:45-10:00am	Symposium Day One Session 1 Part 1	
10:00-11:10am	Coffee Break & Poster Session	
11:10am-12:30pm	Symposium Day One Session 1 Part 2	
12:30pm	Symposium Photograph	
12:35pm	Lunch	
1:30-2:50pm	Symposium Day One Session 2 Part 1	
2:50-3:30pm	Coffee Break & Poster Session	
3:30-4:30pm	Symposium Day One Session 2 Part 2	
7:00pm	Symposium Dinner	Clare College
Friday, April 5: Symposium Day Two		
8:45am	Registration opens*	Clare College Gillespie Centre, Memorial Court
9:20-10:45am	Symposium Day Two Session 3 Part 1	
10:45-11:25am	Coffee Break	
11:25am-12:15pm	Symposium Day Two Session 3 Part 2	
12:15pm	Lunch	
1:30-2:30pm	Symposium Day Two Session 4 Part 1	
2:30-3:00pm	Coffee Break	
3:00-4:30pm	Symposium Day Two Session 4 Part 2	

Please see ***Section 5*** for maps, and more venue details

Symposium Day One: Thursday, April 4, 2024

Welcome Address	
8:45am	**Jess Gwynne,** University of Cambridge **Claes Fredriksson,** Ansys Academic Development Team
8:55am	**Dipankar Choudhury,** Office of the CTO, Vice President, Research at Ansys
9:00am	**Session 1: Insights in materials teaching and immersive learning experiences** Chair: Maria Asuncion Valiente Bermejo, University West
9:00am	**Maria Asuncion Valiente Bermejo,** University West *Developing and implementing virtual reality labs: an example of multidisciplinary collaboration*
9:20am	**Bonnie Attard,** University of Malta *Applying a practical approach to materials selection*
9:40am	**Chamila N Liyanage,** National University of Singapore *Breaking Barriers: Fostering Comprehensive Learning in Engineering Principles and Practice through Virtual-Physical Lab Integration*
10:00am	*Poster Session Teaser*
10:30am	*Coffee Break & Poster Session*
11:10am	**Joana Martins**, TU Delft *When Biology meets Designers: Insights from a Biologist's Teaching Journey*
11:30am	**Nicole Johnson-Glauch,** California Polytechnic State University *Let's Talk About Assessment: Oral Assessments in Materials Engineering Course Design*
11:50am	**Roald Lilletvedt,** Norwegian University of Science and Technology *Wiser after Failure Analysis*
12:10pm	*Session Discussion, Chair*
12:30pm	*Symposium Photograph & Lunch*
1:30pm	**Session 2: Outreach and Community** Chair: Paloma Fernández, University Complutense
1:30pm	**Ehsan Ghassemali,** Jönköping University *Advanced School on Circular Metal Components for the Swedish Manufacturing Industry - CIRCUMET*
1:50pm	**Paloma Fernández,** Department of Materials Physics, University Complutense *Materials: the great unknowns*
2:10pm	**Chris Hamlett,** National Outreach Officer for Materials Science and Engineering *Discovery Materials*
2:30pm	**Zhili Dong,** Nanyang Technological University *The Discover Materials! Project: Challenges and opportunities in materials engineering education and sustainable development*
2:50pm	*Coffee Break & Poster Session*
3:30pm	**Fred Veer,** TU Delft *Designing for the built environment in the mid and late 21st century, what to teach students*
3:50pm	**Yves Brechet,** French Academy of Sciences and Scientific Director of Saint Gobain *A multimaterials company for sustainable construction Member of the French Academy of Sciences*
4:10pm	*Session Discussion, Chair*
4:30pm	*End of Day 1*

Symposium Day Two: Friday, April 5, 2024

9:20am	**Summary of Day 1**
9:25am	**Session 3: Generative AI in materials teaching and assessments** Chair: Deborah Blaine, Stellenbosch University
9:25am	**Alison G Harvey,** University of Manchester *Controversies and Scandals as a tool for Teaching and Learning about Responsible Research and Innovation in Materials Science*
9:45am	**Dattatraya Parle,** University of Sheffield *Innovative Text-based Generative AI Approach for Enhanced Learning Experience*
10:05am	**Leonard Ng Wei Tat,** Nanyang Technological University *Revolutionizing Materials Education: Introducing an LLM-Powered Chatbot Tailored for Personalized Instruction in Materials Science and Engineering*
10:25am	**Deborah Blaine,** Stellenbosch University, South Africa *The development of evaluative judgement in materials engineering through the use of generative artificial intelligence*
10:45am	*Coffee Break & Poster Session*
11:25am	**Pierre Yser, Thibaut Munzer,** Ansys *Using Deep Learning as a teaching tool for engineers: quick assessment 3D models*
11:45am	*Session Discussion, Chair*
12:15pm	*Lunch Break*
1:30pm	**Session 4: Sustainability in novel materials and design** Chair: Tatiana Vakhitova, Ansys Academic Development Team
1:30pm	**Guillermo R. Facal,** University of Buenos Aires *Sustainability in Mechanical Design, Material Selection and Manufacturing*
1:50pm	**Dina Jacobsen,** Copenhagen School of Design Denmark EA *Experimental analytical learning in sustainability assessment education*
2:10pm	**Steffen Ritter,** Reutlingen University *Fantastic Plastic - The importance and benefits of plastic products in the area of conflicting consumer needs, environmental protection, resource management and image*
2:30pm	*Coffee Break*
3:00pm	**Stefano Parisi,** TU Delft *Navigating Time and Sustainability in Material-Driven Design*
3:20pm	**Neha Chandarana,** Bristol University *Introducing authentic assessments in the unit Composite materials for sustainability*
3:40pm	**Daphiny Pottmaier,** Nottingham Trent University *Fostering Sustainability Across Engineering Courses: A Diverse Approach with Ansys Granta EduPack*
4:00pm	*Session Discussion, Chair*
4:30pm	*End of Day 2*

Section 2: Participants

Name	Affiliation	Presenting			Country
		Workshop	Talk	Poster	
Abduljabar Alsayoud	KFUPM				Saudi Arabia
Alexia Chabot	Université Libre de Bruxelles				Belgium
Alfred Oti	Ansys				UK
Alison Harvey	The University of Manchester		X		UK
Andrea Marinelli	Politecnico di Milano				Italy
Ann Zammit	University of Malta				Malta
Anthea Agius Anastasi	University of Malta				Malta
Antoine Tour	Paris Sciences et Lettres University			X	France
Bonnie Attard	University of Malta		X		Malta
Chamila Nishanthi Liyanage	National University of Singapore		X		Singapore
Chris Hamlett	The University of Birmingham		X		UK
Claes Fredriksson	Ansys	X		X	UK
Claudio Tosto	University of Catania				Italy
Daniel Ghassemali	Tekniska Högskolan i Jönköping				Sweden
Daphiny Pottmaier	Nottingham Trent University		X		UK
Dattatraya Parle	University of Sheffield		X		UK
David Mercier	Ansys			X	France
Deborah Blaine	Stellenbosch University		X		South Africa
Dina Jacobsen	KEA		X		Denmark
Dipankar Choudhury	Ansys				United States
Ed Pickering	The University of Manchester				UK
Ehsan Ghassemali	Tekniska Högskolan i Jönköping		X		Sweden
Elisabeth Hülse	Ansys			X	Germany
Fred Veer	TU Delft		X		Netherlands
Gerhard H. Olsen	Norwegian University of Science and Technology				Norway
Graham McShane	University of Cambridge				UK
Guillermo Rubén Facal	University of Buenos Aires		X	X	Argentina
Hannes Geist	University of Freiburg				Germany
Harriet Parnell	Ansys			X	UK
Hemin Adelmand	Aliaxis Research and Technology				France
Imran Siddique	Ansys				UK
Itai Vutabwarova	University of Sheffield				UK
Ivana Slamova	University of West Bohemia				Czechia
Jakub Radkovsky	University of West Bohemia				Czechia
James Elliott	University of Cambridge				UK
János Plocher	Ansys	X		X	Germany
Javier Orozco-Messana	Universitat Politecnica de Valencia			X	Spain
Jess Gwynne	University of Cambridge				UK
Joana Martins	TU Delft IDE		X		Netherlands

Name	Affiliation	Presenting			Country
		Workshop	Talk	Poster	
Joel Galos	Cal Poly			X	United States
Kaitlin Tyler	Ansys	X		X	United States
Kathryn Jackson	University of Sheffield				UK
Katie Moore	The University of Manchester				UK
Lakshana Mohee	Ansys				UK
Lee Phillips					UK
Leonard Ng Wei Tat	Nanyang Technological University		X		Singapore
Madelene Zetterlind	Jönköping University				Sweden
Maria Asuncion Valiente Bermejo	University West		X		Sweden
Mengying Liu	Washington and Lee University				United States
Michalis Constantas	Ansys				UK
Mike Ashby	University of Cambridge	X			UK
Navid Manai	Ansys	X		X	UK
Neha Chandarana	University of Bristol		X		UK
Nehir Kandemir	Ansys				UK
Nicolas Martin	Ansys				France
Nicole Johnson-Glauch	California Polytechnic State University		X		United States
Noel Rutter	University of Cambridge				UK
Paloma Fernández Sánchez	University Complutense		X		Spain
Peiyu Chen	University of Cambridge				UK
Penny Thomopoulou	Ansys				UK
Peter Hammersberg	Chalmers University of Technology			X	Sweden
Pierre Yser	Ansys		X		UK
Plinio Fernandes Borges Silva	Chalmers University of Technology				Sweden
Regina Ritter	Reutlingen University				Germany
Risto Ilola	Aalto University				Finland
Roald Lilletvedt	NTNU		X		Norway
Robert Thompson	University of Cambridge				UK
Rola Saad	Unviersity of Sheffield			X	UK
Rosita Bannert	The London Interdisciplinary School			X	UK
Sabina Rebeggiani	Halmstad University				Sweden
Sebastian Limberg	Hochschule Reutlingen			X	Germany
Sheng Guo	Chalmers University of Technology				Sweden
Shwe Soe	UWE BRISTOL				UK
Sokkalingam Rathinavelu	Karlstad University				Sweden
Stefano Parisi	TU Delft		X		Netherlands
Steffen Ritter	Reutlingen University		X	X	Germany

Name	Affiliation	Presenting			Country
		Workshop	Talk	Poster	
Stephane Gorsse	University of Bordeaux			X	France
Susannah Cooke	Ansys				UK
Tatiana Vakhitova	Ansys				UK
Thibaut Munzer	Ansys		X		UK
Thomas Magnac	Ansys				UK
Tomáš Mánik	Norwegian University of Science and Technology			X	Norway
Uta Arning	Uma pictures				Sweden
Vijeth Reddy	Halmstad University				Sweden
Wen Zhao	Ansys			X	UK
Xiaolei Feng	Nanyang Technological University				Singapore
Yves Brechet	SAINT GOBAIN		X		France
Zhili Dong	Nanyang Technological University		X		Singapore

Section 3: Presentation Abstracts

Developing and implementing virtual reality labs: an example of multidisciplinary collaboration

Daniel Sjölie, Zakarias Mortensen, Clara Larsson, Peigang Li, Tahira Raza, Maria Asuncion Valiente Bermejo*
University West

The integration of virtual reality (VR) laboratories into welding education presents an array of potential advantages. It can be campus or distance-based, and it offers an alternative when access to traditional laboratories is challenging. The economic benefits, including savings on material preparation and energy costs, along with the environmental, health and safety advantages of mitigating exposure to welding fumes, arc radiation, and electrical hazards, add further value and contribute to sustainability in welding education. The work presented here is an example of the integration of education and research. Research in the field of immersive technologies, and education in the areas of welding and informatics. A multidisciplinary team worked on the development of an immersive learning environment, including virtual laboratory areas for welding processes as well as for microstructural inspection of welds. During the project, this learning environment, and the contained virtual laboratories, have been implemented by the researchers with the support from IT students, and tested, and improved with the feedback provided by students in welding technology, materials science, and manufacturing courses. Overall, more than twenty students from Informatics have been involved throughout the project, resulting in five bachelor theses, three master theses, three course projects in Immersive computing, and two course projects focusing on web development. The involvement of IT students has not only supported the development of the virtual learning environment, but it has also created new avenues for future research and developments in immersive computing.

Applying a practical approach to materials selection

B. Attard*, A. Agius Anastasi, A. Zammit
Department of Metallurgy and Materials Engineering, University of Malta

The discipline of materials science and engineering often poses challenges for students, who struggle with understanding the application of the theoretical concepts within a practical context. To address this issue, the Department of Metallurgy and Materials Engineering at the University of Malta has introduced a new module designed to promote an engaging and applied learning experience. This presentation provides an overview of the approach adopted in designing the module and its content. This module employs a dual approach, blending theoretical elements with practical implementations. Students are taught advanced materials selection techniques and are given the opportunity to work through several structured examples on specific products in a classroom setting using the Granta EduPack 2020 materials selection software, engaging them with the subject matter. Complementing the theoretical aspects, the module incorporates practical laboratory sessions during which the students dismantle and analyse a practical component, such as a pump or electrical motor. Utilising various analytical techniques, they identify the material composition of the main parts. In parallel, students engage in material selection exercises, applying classroom-learned concepts to select the optimal materials for the identified components. A crucial aspect involves a critical comparison between their selected materials as aspiring engineering designers and the materials actually used in the physical components. This holistic approach not only nurtures technical skills in using power and hand tools, employing simple characterisation techniques and utilising materials selection software, but also extends to understanding how manufacturing techniques influence material structures. Discussions on the implications of manufacturing methods enrich students' comprehension of the intricate relationship between material selection and manufacturing processes. In essence, this multifaceted approach seeks to bridge the gap between theoretical learning and practical application, providing students with a comprehensive educational experience in materials engineering.

Breaking Barriers: Fostering Comprehensive Learning in Engineering Principles and Practice through Virtual-Physical Lab Integration

Chamila N Liyanage
National University of Singapore

In the diverse realm of lab-based modules, addressing the inherent limitations created in traditional approaches is deemed crucial for the encouragement of an effective learning experience. As the lead instructor for lab sessions across various modules, common challenges have been identified, including the limited prehensive ability of students, time constraints, and insufficient opportunities for repetition. These factors often lead to a mechanical adherence to lab manuals, hindering the construction of meaningful knowledge.

In response, when developing the module; Engineering Principals and Practice 2 (EPP2) for 1st year undergraduates in Materials Science and Engineering department at National University of Singapore (NUS), involved the strategic integration of virtual labs to overcome these challenges. As a virtual lab is not a replacement for hands-on experiences, the introduced system was a hybrid approach. The learning process is initiated by the students with virtual labs to build confidence through familiarity and then seamlessly transitioning to physical labs for a comprehensive experience. Literature suggests that this hybrid model enriches the learning experiences of students.

The virtual lab phase aims to empower students with enhancing skills in data manipulation and interpretation under different scenarios. Aligned with Kolb's experiential learning cycle, this approach activates the prehension dimension, promoting efficient knowledge transformation. Visual aids in virtual labs, consistent with Weenk's learning pyramid model, contribute to superior knowledge retention compared to traditional methods.

To supplement the self-paced learning initiated by the virtual labs, home-based lab kits were distributed, extending the learning environment beyond the classroom. Use home-based lab kits were also intended to encourage the practical application of knowledge.

This innovative approach represents a paradigm shift in lab-based education, combining the strengths of virtual and physical labs to create a holistic and impactful learning experience which better promote knowledge application in practical problem solving.

When Biology meets Designers: Insights from a Biologist's Teaching Journey

Joana Martins
Industrial Design Engineering, Delft University of Technology, Delft, Netherlands

Microorganisms have long fascinated humanity. Their mysterious and resilient nature have captivated curiosity, leading to the discovery of many scientific marvels. Fascinated by microorganism's potentials, today's designers urge to include them in their practices through Biodesign. Aiming ground-breaking innovations, biodesign harnesses the inherent abilities of biological systems, such as living microorganisms, to produce sustainable materials that can grow, self-organize, and self-repair, contributing to the 'decrease of ecological footprint' and/or 'novel materials expressions. The integration of biological materials into the designer's palette, alongside with chemical and algorithmic elements, marks a significant evolution in material exploration.

To achieve biodesign purposes, designers must speak biology's language. Despite the increasing research and practice endeavours, within and outside academia, design faculties still lack in their curriculum basic biodesign training for future designers.

To bridge this gap, we have developed at Industrial Design Engineering, TU Delft, the first dedicated course in this field: Fundamentals of Biodesign (FBD), introduced in 2022 as a Master Elective within the Integrated Product Design master's program. FBD course gradually delves into the world of 'microbiology', 'biotechnology' and 'biodesign', offering the students an unprecedent opportunity to understand and explore living microorganisms during their design academic trajectory. Those explorations form the basis for analysing the most 'recent developments in biodesign' and cultivating essential skills for future practices in the field.

In this talk, FBD course structure, methodologies, and tools will be presented and serve as a guide to the teaching journey of a biologist aiming to educate design students in the realm of biology. The unique challenges, strategies, and transformative insights encountered in this interdisciplinary dynamic will be uncovered. Ultimately, this talk aims to stimulate an engaging discussion and illustrate how the combination of this distinct disciplines can nurture a new wave of thinkers and practitioners poised to tackle new and complex challenges.

Let's Talk About Assessment:
Oral Assessments in Materials Engineering Course Design

Nicole Elizabeth Johnson-Glauch
CalPoly San Luis Obispo

Oral communication is a critical engineering competency. All of the following are examples of how practicing engineers are expected to demonstrate their engineering knowledge and problem solving.

Technical interviews.
Design Reviews.
Team meetings.
Public meetings.
Internal or client-facing technical presentations.
Conference talks.
Conference poster sessions.

This is a wide range of situations. Yet, students' ability to orally communicate their knowledge and problem solving is typically assessed using individual or group presentations. That's even if it is assessed at all as many courses rely exclusively on written assessments.

Recently, the engineering education community has started assessing the viability of using alternative assessments such as oral exams to evaluate engineering competencies. In this interactive talk, I will showcase three different ways to incorporate alternative oral assessments into lower and upper division materials engineering courses. Each will include data on student performance and tips and tricks for implementation based on audience interests.

Wiser after failure analysis

Roald Lilletvedt*, Kjersti KlevelandGerhard Henning Olsen
Norwegian University of Science and Technology, Trondheim

”Injury makes you wise” is an old Norwegian saying[1]. (A vaguely related saying in English is “what doesn’t kill you makes you stronger.”) Failure analysis is the natural culmination of two years of building relevant material competence in the bachelor’s degree programme in Materials Engineering at NTNU.

In a project starting now, we want to structure and coordinate the teaching better, link the teaching more clearly to learning outcome descriptions in both one specific course and the study programme, and in particular to streamline formative assessment to improve the learning outcome in several activities.

The failure analysis is the final activity in a course that contains characterisation methods (XRD, SEM, LOM and NDT) and fracture mechanics, both theory and practical work in the laboratory. Cases and guest lectures from relevant companies are also included.

We are starting a project where we will evaluate different types of assessment (formative and summative) and their influence on learning outcome. The course will be divided into four learning packages. In the first three packages the students will acquire knowledge and skills that are necessary for solving real-life failure cases presented in the fourth package. Each learning package will have clearly defined learning outcomes that will be assessed in several ways. Some examples are digital self-assessment in newly developed tests, feed-back from student assistants, laboratory engineers and professors, peer evaluation from other students and reflection individually and in groups.

1 From Latin Felix, quem faciunt aliena pericula cautum from www.snl.no

Advanced School on Circular Metal Components for the Swedish Manufacturing Industry – CIRCUMET

Ehsan Ghassemali*, Madelene Zetterlind
School of Engineering, Jönköping University

Metal component manufacturing is a sector that "Contributes significantly to the GPD of Europe but is also responsible for a large share of CO2 emissions". This explains the motivation why metal component manufacturing requires urgent competence supply focused on climate change. Moving towards a circular economy requires a revisit to the entire value chain of component manufacturing. The urgent need to fight the climate challenge requires new solutions and cannot be accomplished without needs-adapted training and competence development in the industry and academia. Such effort is also key for sustainable growth and competitiveness in the field, which can lead to improved income and employability for society. This emphasises the important roles of future materials engineers that must include circularity, sustainability, and digital and virtual solutions to integrate materials and manufacturing. CIRCUMET initiative (6 yrs externally funded project) has the ambition to develop and execute tailored and concise needs-motivated advanced courses (80-90 credits in total) for the metal component manufacturing sector, with the fight against climate change as the core concept. The main target students for the courses are professionals working in the industry, while campus students are welcome also in take the courses. It is, therefore, crucial to develop innovative and adapted routines for admission and validation of students who want to take university courses. To increase the attractiveness of courses for professionals, flexible teaching methods need to be developed. The content of courses is also developed based on current and future industrial needs through close collaboration. Top-tier Swedish higher educational institutes (HEIs) active in metal component manufacturing (School of Engineering at Jönköping University, Chalmers University of Technology, and University West) create a comprehensive task force, together with the Research Institute of Sweden (RISE), ten major industrial partners in the field, and five related industrial associations, for creating the comprehensive educational package. The industrial partners include large companies and SMEs in the entire value chain of metal component manufacturing, from material suppliers to manufacturers and end-users of metallic components in various sectors ranging from household appliances to automotive and aerospace. This talk will provide an overview of the "CIRCUMET methodology" for developing lifelong learning packages for the industry. We will discuss challenges and innovative possibilities in this regard.

Materials: the great unknowns

Paloma Fernández
Department of Materials Physics, University Complutense

The purpose of this research is to review two modules within the apprenticeship degree programmes at the Advanced Manufacturing Research Centre (AMRC), The University of Sheffield in which sustainability was a key focus. Our talk and poster will outline the framework for the modules, explaining the motivations behind the sustainability drive, the aim, objectives and assessment methods of the modules, and the teaching practices employed.

All of the apprentices are employed at engineering organisations and are working towards their apprenticeship standards through undertaking a BEng degree at the AMRC. During the second year of study, the apprentices undertake two modules; 'Multidisciplinary Design' and 'Professional Engineering and Sustainable Manufacturing'. These modules were previously run independently and although sustainability played a small role, it was not the primary focus of the modules. Over the last two years we have revised the learning outcomes and improved the alignment between the modules to ensure that sustainability is at the forefront of the curriculum.

Sustainability has seen an increasing importance in engineering, as reflected in the revised professional engineering standards (AHEP4) and our University's strategy and action plan. We wanted to broaden the apprentices' view of what sustainability means from a social, economic, ethical and environmental perspective. The aim was to avoid shoehorning it into the modules, but to encourage the apprentices to think critically about how it related to their own organisations and the wider society.

The talk will discuss the strategies used to engage the apprentices in exploring the topic using Ansys Edupack for evaluating sustainable developments within the manufacturing industry, whilst also considering the wider implications through the Earthshot initiatives. The poster will detail the learning and teaching approach, including how the modules were structured and the use of peer feedback to assist in developing successful group work communication.

Discover Materials

Chris Hamlett
National Outreach Officer for Materials Science and Engineering

Discover Materials is a working group from ten UK universities that was set up to address the issue of low applications for undergraduate Materials Science and Engineering (MSE) courses compared to other science and engineering disciplines.

We work in partnership with a range of organisations, such as the Henry Royce Institute, to promote MSE via their website (***www.discovermaterials.co.uk***) and both online and in person activities. Such interactions include large science festivals, local events and teacher CPD sessions to help equip teachers with the knowledge, and awareness, of the area to help signpost their students to a discipline they may otherwise not have heard of. This talk will give an overview of how Discover Materials has evolved and grown since the Heads of Materials Departments (HoDs) meeting in 2017 through to growing a network of more than 80 ambassadors who promote MSE to school children and both their teachers and families to help raise the profile of the discipline. We will outline how you can get involved to help inspire the next generation of Materials Scientists and Engineers.

Challenges and opportunities in materials engineering education and sustainable development

Dong ZhiLi
School of Materials Science & Engineering, Nanyang Technological University

Students in materials science and engineering field need to learn about the latest trends. These new trends require some changes in the curriculum design, as well as in faculty development and training. Faculty needs to think how to teach such courses which contribute to sustainable materials education development.

Some efforts have been made to import sustainable development principles in MSE, NTU. First, project-based learning has been implemented which can help students learn about sustainable engineering and relevant problem-solving skills. In our group, we accept final year undergraduates to join our clean energy related materials research projects [1], and engage with issues concerning carbon neutrality, global warming, dwindling energy supply, and renewable energy. Our process allows us to incorporate sustainability principles and practices into materials engineering education.

Second, some international collaborative projects and programs have been initiated, which bring together students and educators from diverse backgrounds. For example, we have worked together with Commissariat à l'Énergie Atomique (CEA) France and have sent our students to France to learn how materials aspects can reduce energy consumption. Meanwhile, we have accepted visiting students from France, China and Japan to promote these collaborations.

Third, our students have the tradition to do internship in local industries for one semester during their four years of studies. We have chosen some companies and proposed projects that are focused on sustainable engineering practices. For example, two of my students are working on water resource development projects in a research center during their industrial attachments.

In materials education, we have also put in effort in our teaching to assimilate the changes due to overwhelming technology advancement. In my class of X-ray diffraction and transmission electron microscopy, some students are from different countries and/or from different disciplines, including physics, civil engineering, environmental engineering, mechanical engineering, electrical engineering, and chemical engineering. I have tailored my teaching in a more effective way to explain the difficult concepts from the viewpoints of physicists, chemists, and materials scientists [2]. After receiving students' feedback, adjustments and new planning was made more effectively.

Through discussions with students, we know what skillset they would like to acquire at NTU. However, I consider that their educations should be "future proof". As a university professor, we must remember that we are educating students and we need to motivate them to serve the society. Although the technical skills they learned are useful to their future careers, the holistic development of young students will enable them to contribute much more in their careers in this continuously changing society.

References:
[1] Upcycling of steel pipeline structures through functional grading for hydrogen fuel transport and storage, Tier 1 project RG141/22 sponsored by the Ministry of Education, Singapore.
[2] ZhiLi Dong, Fundamentals of Crystallography, Powder X-ray Diffraction, and Transmission Electron Microscopy for Materials Scientists, Taylor & Francis / CRC, Published in May 2022.
Acknowledgement: The author would like to thank the Ministry of Education, Singapore for supporting our Tier 1 project RG141/22 "Upcycling of steel pipeline structures through functional grading for hydrogen fuel transport and storage". The author would also like to express his gratitude to Professor Raju V. Ramanujan for his helpful discussions.

Designing for the built environment in the mid and late 21st century, what to teach students

F.A. Veer
TU Delft

Except for the architect who designed the great pyramid at Gizeh, few architects get a design brief to design for eternity. Although looking at the almost unchanging face of cities like Cambridge and Delft you can easily get a different impression. While the monumental scope of buildings like Norman Foster's Gherkin in London in many ways is a design as monumental as Nelson's column.

Modern reality is however in some way the opposite of designing for eternity. Double glazing has at best 20 years before it leaks and needs to be replaced. PV panels have a life of 15 years. Many people change their kitchen and bath room every 10-20 years. Appliances are changed more often. Central heating units are changed every 15 years.

Although this is not at the level of mobile phones which are changed every year by many people. There is still a major sustainability problem in how we design the built environment, especially considering the huge amount of materials used, most of which is currently not reused. The traditional approach to designing the building for an infinite life negates the actual changes in the use of the building. In a house the children move out at a certain point and a third of the house stands empty. In a mid 20th century government office the internal lay-out has been changed several times due to the need to put in an IT backbone that it was not designed for, while the internal lay-out, toilets, kitchenettes have been changed several times as have the appliances and installations. Increased environmental pressure requires a different way of thinking. A steel girder can last centuries, but in those centuries can be part of many different buildings. Re-use at component level has far greater environmental benefit rather than recycling the steel because that eliminates the energy required for melting and rolling.

The inevitable conclusion is that in order to meet the Paris accords we need to design buildings for a limited life, but the building components both for an infinite life and easy assembly/disassembly. This requires significant adaptations to how we teach materials science to students in the built environment disciplines. The results of some experiments in teaching this way will be shown and the critical part that eco impact calculations play in making students aware of the need to approach design differently.

Day One, 3:50pm

Saint Gobain: a multimaterials compagny for sustainable construction

Yves Brechet

Yves Brechet, Scientific director of Saint Gobain, Member of the French academy of sciences

Saint-Gobain is a compagny created under Louis the XIVth to ensure France independence with respect to mirrors imported from Venice. Since then, and without interruption, it has grown in a multimaterials compagny, producing glass, plaster, ceramics, polymers and composites, cast iron, to create products such as windows, insulating wools, plasterboard, windshields, abrasives, chemical for construction, polymers for life science, radomes.

To address such a variety of materials and applications, the competences involved in the research centers range from materials sciences, chemistry, thermal modelling, mechanics and fluid mechanics, to data science and computer modelling. This offers a truly cross disciplinary environment where both research and development are carried out in a long term perspective as well as in a direct service to the business.

The methods developed over the years by M.Ashby's school, both for materials and process selection, for architecture materials design, and for materials sustainable design, find here a natural industrial application.

In addition, the commitments of the company toward carbon neutrality has led to the development of decarbonation of industrial processes, as well as to the creation of products allowing our clients to decrease their carbon footprint.

Thanks to this approach, Saint-Gobain claims to be a leader of materials and product for sustainable construction. The presentation will give examples both of "materials by design" and of "process decarbonation" where every facet of material science has to be explored , and every tools available both in industry and academia, both in characterization and modelling, play a key role

Controversies and Scandals as a tool for Teaching and Learning about Responsible Research and Innovation in Materials Science.

Alison G Harvey
University of Manchester

Responsible Research and Innovation (RRI) is a concept developed by the European Commission and a cross-cutting theme within Horizon 2020. Various approaches to RRI have subsequently been adopted by funding bodies throughout Europe, including the UKRI/EPSRC AREA framework.

Key aspects of RRI are highlighted by Horizon 2020 key elements: gender equality, science education, public engagement, governance, research integrity, open access, sustainability and social justice. More generally approaches to RRI encourage: Anticipation, Reflection, Engagement and Action relating to potential positive and negative impacts of research and innovation.

RRI as a framework therefore provides a structure for teaching these relevant topics. However, over the past 5 years of creating and teaching a unit specifically focused on RRI (for 1st year PhD students), some challenges have been clear. In particular, encouraging engagement with topics which are seen as 'social science' and therefore 'not relevant'. An approach that has worked well has been the use of 'controversies and scandals' as a way to connect students' materials science knowledge with the wider social implications of research, innovation, and professional practice.

The study being presented here is in collaboration with a group of students, recognising the challenges they face when learning about RRI, and exploring how a set of controversies and scandals can be mapped against the key elements of RRI to use as a tool for teaching and learning around these topics more broadly.

Innovative Text-based Generative AI Approach for Enhanced Learning Experience

Dattatraya Parle
University of Sheffield

In the age of Artificial Intelligence (AI), Generative AI has revolutionised the world with applications such as ChatGPT. It has impacted the education sector the most. Schools and universities are struggling to adapt to this shift. While some universities are banning the use of Generative AI, others are crafting policies for responsible use. However, one thing is clear that schools and universities can't prevent the students and teachers using ChatGPT and other Generative AI applications. It will be a wise decision to proactively adopt these technologies and integrate in the teaching learning process. Generative AI has the potential to revolutionise the teaching learning experience. Therefore, this abstract presents an innovative approach by leveraging the power of text-based Generative AI in education. In this pilot case study, we aim to demonstrate the possibility of development of a customised generative AI model for teaching of Mould and Tooling course by training an open-source Large Language Model (LLM) on selected textbooks used by the teacher during teaching the curriculum. Our primary goal is to showcase the feasibility of employing customised text-based Generative AI in education. In this pilot study, we aim to develop a customised learning assistant that augments traditional teaching methods. By training an LLM on selected books, we can generate personalised summaries, practice problems, and question answer type interactions. This approach has the potential to revolutionise education by providing students with a more engaging and effective learning experience. This idea represents a pioneering step toward leveraging Generative AI for subject-specific learning. This presentation will demonstrate the development process, showcase the capabilities of the text-based Generative AI, and discuss the potential impact on education.

Revolutionizing Materials Education: Introducing Professor Leodar, an LLM-Powered Chatbot Tailored for Personalized Instruction in Materials Science and Engineering

Leonard Ng Wei Tat
Nanyang Technological University

Large language models (LLMs) such as OpenAI's GPT-3.5 and GPT-4, although disruptive in materials education, have proven to be too general and lack domain-specific knowledge.

Specifically, we observe that the use of ChatGPT by students in our course MS0003-Introduction to Data Science and Artificial Intelligence in the School of Materials Science and Engineering at Nanyang Technological University, has had limited success. Responses generated were generally verbose, with no evidence of student learning.

Here, we present Professor Leodar, a custom-built chatbot we have developed using retrieval augmented generation (RAG). The chatbot is designed to provide personalised instruction to materials science engineering undergraduates. Professor Leodar is grounded in a corpus of materials which include lecture materials (slides, Jupyter Notebooks etc), lecture video recordings from the previous year and introductory textbooks to create a corpus of data. It is also built with the support of Amazon Web Services and hosted on inbuilt cloud systems that facilitate the building of LLM applications.

In this talk I will present this LLM-powered chatbot, the process of which we went through to build the tool, and how we are evaluating the tool. I will also present some of the technologies available from tech providers that other educators can use to build their LLM powered solutions for their classes.

The development of evaluative judgement in materials engineering through the use of generative artificial intelligence

Deborah Blaine* and Melody Neaves
Mechanical & Mechatronic Engineering, Stellenbosch University, South Africa

The past few decades have been marked by the disruptive changes brought on through the advent of the internet that has led to the mass democratisation of knowledge. A concomitant consequence, and threat to our learners in higher educations, is the rampant levels of decontextualised, inaccurate information that can easily be misinterpreted. Widespread misinformation can be both dangerous and damaging to the advancement of knowledge. It has thus become incumbent on institutes of higher education to help our learners to develop a robust ability for evaluative judgement. The urgent need for this skill has become even more prevalent with the latest technological disruption, generative artificial intelligence (AI). In our study, we designed a set of short assignments within an introductory course on materials science for undergraduate engineering students, that tasked them with directly engaging with generative AI linked to large language models (LLMs), such as OpenAI's ChatGPT platform. Learners were required to set up high quality assessment questions, related to the properties and applications of polymers, ceramics, metals and composites, via a series of prompts to generative AI platforms. They were required to progressively refine the question and model answer through interrogating the responses provided by the LLMs. This required them to critically evaluate and judge the veracity of the generated information through engaging with the course content and by referencing verified sources. Additionally, learners were required to submit a report detailing the progressive development and evaluation of their questions and answers for peer assessment. This provided an additional opportunity for learners to develop evaluative judgement and to engage critically with the course content while learning with and from their peers. The results showed that our primarily GenZ learners were proficient in engaging with and utilizing the internet and generative AI as a learning tool. Learners who engaged with the generative AI platform extensively learnt far beyond the required level of knowledge synthesis for the course, while those that approached the task superficially were judged, sometimes harshly, for the poor quality of the information they provided in their reports. The internet essentially provides fodder for the creation of knowledge for our younger generations. Generative AI can and should be used as a powerful tool to promote learning and the development of critical evaluative judgement, to prepare our graduates for a world of crowdsourced information. In this study, we showed how generative AI can be responsibly incorporated into the materials engineering curriculum to the benefit of our learners.

Using Deep Learning as a teaching tool for engineers: quick assessment 3D models

Pierre Yser* and Thibaut Munzer
Ansys

Deep learning algorithms have revolutionized various fields, including computer vision and natural language processing. Extending these capabilities to engineering education presents an opportunity to enhance learning outcomes and streamline the design process. In recent years, there has been a growing interest in utilizing deep learning techniques as educational tools in engineering disciplines. This talk explores the potential of employing 3D deep learning models as a means to instruct engineers in design principles and problem-solving strategies without the need for extensive simulation time. The authors aim to elucidate the methodology and benefits of integrating such models into engineering education. By leveraging 3D deep learning models, educators can provide students with intuitive insights into complex engineering concepts, facilitating a deeper understanding of design principles and problem-solving techniques.

Sustainability in Mechanical Design, Material Selection and Manufacturing

Guillermo R. Facal*, Eriel A. Fernández Galván, José María di Iorio, Estebán Pizzichini, Lucas Perfumo, Carlos Gérez, and Rafael A. Schiazzano
University of Buenos Aires

One of the premises of today's world is to use sustainable products in all areas, aeronautical, aerospace, automotive, household appliances, etc. To obtain these products, it is required at all stages of the life of a product. For this reason, we believe that it is essential to promote in our courses the idea that the design, manufacturing and subsequent use is sustainable. In this work we will refer to it and what guidelines we follow for sustainable products from the selection of materials, the mechanical design in CAE and CAD systems, the simulation in CAE software and both additive and chip removal manufacturing in FDM and CAM systems. respectively.

The subjects in which the project was carried out are Machine Elements, Machine Project, Mechanical Design Optimization, Mechanical Design Optimization II, Additive Manufacturing Course, Mechatronics Course. All these subjects are part of the curriculum of the Mechanical Engineering career at the Faculty of Engineering of the University of Buenos Aires.

We work in a Wind Turbine, where the materials are selected, the structures, the fluid-structure interface, the mechanical transmissions, the finite element simulation and both additive and chip removal manufacturing are analyzed. Finally, a scale prototype is built where measurements will be taken that will later be used to simulate the data obtained and see the response of the CAD-CAE model (digital twins).

The selection of materials was carried out using the so-called Ashby diagrams and the software was used KISSsoft for the calculations of mechanical transmissions and machine elements, SolidWorks, Inventor and NX for the CAD models and ANSYS for Finite Element Analysis. For the construction of the prototype 3D printers, CNC milling machines and the Inventor CAM and NX CAM software.

Experimental-analytical learning in sustainability assessment education

Dina Jacobsen
KEA -Copenhagen School of Design and Technology

The current digital life cycle assessment tool EcoAudit+has its limitations when working on evaluation of experimental materials.

A teaching method named the experimental-analytic approach has been developed. The approach has been tested several times in the course Sustainability in product development at Copenhagen School of Design and Technology between 2019 and 2022. This talk will cover the conclusions to the question below.

How is the learning experience influenced by implementation of an experimental-analytical teaching approach that enables the student to assess the quantitative impact of alternating a product's existing materials with an experimental biocomposite?

Initiating the process,the students performed experimental work in the material laboratory with the aim of developing a biocomposite, as an alternative material choice. In continuation the students collected data on embodied energy of the material ingredients. The students used desk research to identify the origin, manufacturing process and means of transport of the different material ingredients. They estimated the energy usage by mapping the processes in the laboratory and measuring the energy input of each process. To facilitate the final estimate a digital tool MatBridge was developed to calculate the environmental impact in terms of embodied energy and CO2 equivalents.

The implementation of the experimental-analytical approach gave the students a hands-on experience with real-life sustainability assessment and insights into mechanical trade-offs. Insufficient data from the data collection posed a learning barrier for some and for others a great insight into the complexity of real-life quantitative sustainability assessment.

To conclude the approach has been relevant to teach the process, complexity and trade-off by exchanging an existing material with an experimental bio composite.

Fantastic Plastic - The importance and benefits of plastic products in the area of conflicting consumer needs, environmental protection, resource management and image

Steffen Ritter
Reutlingen University

Everybody is talking about plastic and in a lot of cases it now has a very bad reputation. The pollution caused by plastic waste is now obvious and governments around the world are passing new laws to restrict or even ban the use and distribution of plastics. On the one hand, the image of plastic products is very poor, but on the other hand, we cannot live without them.

Plastic products are currently mainly produced in a linear economy instead of a circular economy, which results in enormous resource consumption and high volumes of waste. In addition, plastics are very stable over the long term and break down into microplastics, which have a lasting impact on the environment. Their load-bearing capacity has already been exceeded in many parts of the world. By 2050, plastic products will produce up to 56 gigatons of CO_2, which will only further fuel the climate crisis. Does this mean we have to eliminate plastics completely? Can we avoid plastics at all?

Plastic products are often much better than their bad reputation. A bad image built up by the media sometimes even leads to far worse material and product alternatives. Examples illustrate this. The industry itself is moving towards a circular economy, even if this still comes with major challenges. Currently the industry is already moving, but so far the image of plastic is not.

That is why we need adequate education everywhere, but especially in the education of young people, in order to inspire young people to work on the complex challenges of today and tomorrow.

Navigating Time and Sustainability in Material-Driven Design

Stefano Parisi* & Elvin Karana
Industrial Design Engineering, Delft University of Technology, Delft

In 2015, the Material Driven Design (MDD) method was firstly published, and later presented at the 8th International Materials Education Symposium. This novel method was developed to facilitate designers in advancing and suitably applying a particular material at the entry point of the design process, emphasising and bridging its unique qualities functionally and experientially. Over nearly a decade, the MDD method has been employed in dedicated courses at the Faculty of Industrial Design Engineering, TU Delft, and adopted by design higher education institutions worldwide, successfully supporting students in exploring, understanding, defining, and mobilising unique material qualities in design.

As materials research constantly evolves, it offers novel and superior alternatives to conventional materials, potentially unlocking novel functions, user experiences, and sustainable solutions in design. Examples include living materials based on microorganisms (e.g., bacteria, algae, fungi), smart materials (e.g., shape-memory alloys and electrochromic textiles), and meta-materials (e.g., 4D printed PLA). Designers face new challenges in MDD projects with these emerging materials with intricate temporal qualities. As materials become alive, active, and adaptive, how could designers better understand and convey their potential for the interest of the planet and society?

These challenges are tackled in the MDD Masters course at the faculty of Industrial Design Engineering, TU Delft. The course structure, methodology, toolkit, and projects are presented. With this course we equip students with the foundational knowledge, tools, techniques to practise MDD projects, with a particular emphasis on capturing, analysing, and anticipating changes in materials (i.e., characterization of temporality in materials), and to reflect on the purpose of the material integrating sustainable thinking (i.e., vision in MDD). Ultimately, this talk aims to stimulate a discussion on how MDD emerges as a catalyst for envisioning a future where materials with temporal qualities can contribute to human and planetary well-being.

Introducing authentic assessments in the unit Composite Materials for Sustainability

Neha Chandarana*, Matthew Leeder, Jacopo Lavazza, Onajite Abafe Diejomaoh, Matthew Lilywhite, Nicolas Darras, Helen McGloin
Bristol University

'Composite materials for sustainability' is a new unit, worth 20 credit points, and is offered to students on undergraduate and postgraduate programmes at the University of Bristol. The unit is compulsory for PGT students taking MSc Advanced Composites and PGR students who are enrolled on the EPSRC Centre for Doctoral Training in Composite Materials. The unit is also available as an option to students in the 4th year of MEng Aerospace Engineering, Mechanical Engineering, and Engineering Design. Previously, a 10-credit unit called 'Sustainable composite materials' (SCM) was taught to the same PGR (compulsory) and PGT (optional) cohorts, with ten didactic lectures and four interactive journal club sessions. SCM was assessed through a single written assessment, where students submitted a report of maximum ten pages. Since the class size was between 15-20, SCM was taught by, and assessed by, one academic.
The following changes have been implemented in the new unit, 'Composite materials for sustainability':

- Individual written assessment (75% summative) is now limited to 2500 words and to be written in the style of an opinion piece
- Introduction of podcast assessment (25% summative, in pairs)
- Introduction of formative podcast assessment and multiple-choice test
- Journal club sessions run in small groups
- Unit delivery and assessment supported by Teaching Associates

In this talk we will present an overview of the changes that have been implemented in the new unit, reflecting on things that did and did not go well. The talk will focus on the authenticity of the formative and summative podcast assessments, and the engagement and feedback from students.

Fostering Sustainability Across Engineering Courses: A Diverse Approach with Ansys Granta EduPack

D. Pottmaier
Department of Engineering, Nottingham Trent University

The teaching and learning developed during the optional module “Sustainability in Engineering Design” situates within a diverse community of students. At our university, this module attracts students from four distinct engineering courses—Biomedical, Electrical and Electronics, Mechanical, and Sports. Therefore, it is a unique and challenging learning environment to integrate Ansys Granta EduPack as a tool to seed sustainable aspects in engineering design while accommodating the diverse backgrounds of the students in a ever more AI intensive world.

The module content begins with an overview of sustainability in the world by using the UN SDGs and our own sustainable university ranked on the UK top 10. The work discusses the challenges and opportunities presented by such diverse body of students while acknowledging the common ground Ansys EduPack provides in preparing graduates to address complex, real-world challenges. It was also observed the powerful tool and how Ansys Granta EduPack and generative chatbots can support discussions and fact-finding activities in sustainable engineering design, regardless of their engineering background. The students could engage with the streamlined Life Cycle Analysis and the materials selection methodology while assimilating more complex concepts. Moreover, practical applications such as redesigning a piece of engineering based on their campus contributed to critical thinking and historical understanding of engineering achievements as well as working with a real Sustainability report as starting point. Net Zero targets and the importance of the Eco-Audit tool were very clear while the work developed, but very distinct between cohorts with high and low engagement.

In conclusion, this work invites educators to reflect on the synergies between sustainability education, diversity, and structured databases in engineering design. By leveraging Ansys Granta EduPack in diverse courses, it not only prepares students for the challenges of sustainable engineering but also nurtures a collaborative and inclusive learning environment representative of the diverse engineering landscape.

Section 4: Poster Overview and Abstracts

Poster Overview

#	Poster Presenter, Affiliation, and Title
1	**Stéphane Gorsse**, Unviersity of Bordeaux *AI and Physical Modeling in Material Science Education*
2	**Alexia Chabot & Stéphane Godet,** Université Libre de Bruxelles, Belgium *Adaptative teaching during COVID – students multi-disciplinary project on beer crafting "tout mais pas la Corona!"*
3	**Tomáš Mánik & Kristian Etienne Einarsrud**, Norwegian University of Science and Technology Implementation of aspects of sustainability and mechanical design in an undergraduate material course
4	**Antoine Tour**, Paris Sciences et Lettres University *Paris Sciences et Lettres University*
5	**Andrea Marinelli, Francesco Iannacci, Flavia Papile, Maria Vittoria Diamanti, Mattia Sponchioni & Barbara Del Curto,** Politecnico di Milano *Higher Education Classroom of the Future. An ongoing EU-funded project on adaptive and immersive education integrating Virtual Reality and Artificial Intelligence*
6	**Asher Barnsdale[1], Joel Galos[2], Bosco Yu[1],** [1]University of Victoria & [2] California Polytechnic State University *Development of a Materials Properties Chart Board Game*
7	**Rola Saad**, The University of Sheffield *Enabling Resilience and Employability Skills in Capstone Projects*
8	**Sebastian Limberg; Dr. Steffen Ritter & Jonas Stratmann**, Reutlingen University *Identification of plastics with simple means and structured flow chart*
9	**Javier Orozco-Messana, Ana Maria Gonzalvez-Pons**, Universitat Politècnica de València *Updating Materials Science Education through Generative AI: A Novel Approach to Interactive Learning*
10	**Plinio Fernandes Borges Silva, Peter Hammersberg & Jonas Tuveson**, Chalmers University of Technology *Experiences of teaching Technical Design Engineer bachelor students a Social-LCA assessment methodology related to early phase material selection*
11	**Shwe Soe, Lucy Corfield, Drew Williams-Hicks, Tamsila Tauqir, Joe Butcher & Carwyn Ward,** Ward University of the West of England *Digital Manufacturing in Aerospace: Creating Project-Based Learning Opportunities for Aerospace Engineering Undergraduate Students*
12	**Guillermo R. Facal, Carlos J. Gerez & Javier Mañé,** University of Buenos Aires *Teaching of Machine Elements integrating CAD and CAE Software for a sustainable design in the Mechanical Engineering Career at FIUBA*
13	**Rosita Bannert,** The London Interdisciplinary School *An interdisciplinary problem-solving approach to learning Materials Science*

#	Poster Presenter, Affiliation, and Title
14	**Meera Sheth,** University College London *Physics for Sustainable Development in the Home: UsingCriticality as a Measure*
15	**Thern Khai Lim**, University College London
16	**Kaitlin Tyler, Jimmy He & David Mercier,** Ansys *Teaching materials science and modeling crystal plasticity*
17	**Elisabeth Hülse & Kaitlin Tyler**, Ansys Academic Development Team *Ansys Education Resources for STEM*
18	**Wen Zhao, David Mercier & Janos Plocher** Ansys Office of the CTO *Materials Informatics in Academia: Challenges and Opportunities*
19	**Harriet Parnell & Elisabeth Hülse,** Ansys Academic Development Team, *International Materials Selection Challenge*
20	**János Plocher, Navid Manai & Lakshana Mohee,** Ansys Academic Development Team *An Additive Manufacturing-oriented Design Approach: A Hip Joint Case Study*
21	**Nick Ball & Claes Fredriksson,** Ansys, *A Technical Biography of EduPack*

1

AI and Physical Modeling in Material Science Education

Stéphane Gorsse
Univ. Bordeaux, CNRS, Bordeaux INP, ICMCB, F-33600 Pessac, France

This poster explores an active learning approach in materials science, focusing on the comparison between physical modeling and AI-based modeling to understand the impact of thermal treatments on alloy hardness. This course is structured in two parts: initially, students engage with the physical principles underlying heat treatment processes, emphasizing precipitation hardening - a crucial phenomenon for enhancing alloy strength. This section encourages critical thinking and teamwork, as students analyze scientific literature to model the effects of alloy composition, treatment temperature, and exposure time on hardness. The challenge lies in constructing a predictive model that efficiently forecasts post-treatment hardness. Transitioning to the second part, we shift from physics-based models to data-driven AI models, illustrating how similar outcomes can be achieved by solely analyzing data patterns. This dual approach not only deepens students' understanding of materials science but also equips them with the skills to bridge traditional and modern research methodologies, fostering a comprehensive educational experience in tackling complex engineering problems through both physical laws and artificial intelligence.

2

Adaptative teaching during COVID – students multi-disciplinary project on beer crafting "tout mais pas la Corona!"

Alexia Chabot, Stéphane Godet
4MAT, Université Libre de Bruxelles

Today, with over 20 million hectolitres produced, beer is one of Belgium's flagships, and the country also provides the widest variety of beers. In 2020-2021, as an active and original contribution to this diversity, the second-year engineering students from the Chemistry, Processes and Materials Science department of Université Libre de Bruxelles were offered to craft and study their own beer in a multi-disciplinary project. The focus of this project was oriented on the Process area, and the aim was to understand the technical and biochemical aspects of beer preparation, as well as the scale-up of its production, via three main works steps: 1) the production and bottling of a beer at two scales: 4L at home (introduced for Covid reasons) and 20L at lab-scale (group work), 2) the analysis of the product quality during and after the production, 3) a theoretical study of dimensioning a heat exchanger, part of a large-scale beer production (200 L). Collective hands-on activities, brewery visit and tasting sessions were planned, as many fun teaching contents as possible to keep the students' motivation and interest in the project throughout the academic year. However, the COVID-19 pandemic interfered with the 2020-21 plans in many ways; adaptative strategies had to be found to complete the project and keep the most added value of this approach to the students. In the poster, the main milestones of this project will be presented: beer recipe design, production & bottling, biochemical analysis, heat exchanger dimensioning and project management. A particular emphasis will be given on how this project-based learning approach was adapted due to the pandemic and corresponding governmental measures. In a way, this peculiar period brought alternative management and communication skills to the students, that will surely be useful in a post-covid professional era.

3

Implementation of aspects of sustainability and mechanical design in an undergraduate material course

Tomáš Mánik, Kristian Etienne Einarsrud

Department of Materials Science and Engineering, Norwegian University of Science and Technology, Trondheim, Norway

This poster presents a possible integration of systematic application of sustainability principles and mechanical design into an undergraduate materials science course. The objective is to enhance students' understanding of materials use through a holistic approach that considers mechanical functionality in combination with the environmental, societal, and economic impact. The poster will detail the timeline for the lectured topics, optional exercise sessions and the incorporation of collaborative project work, reporting and presentation. It is demonstrated how these elements contribute to a well-rounded educational experience. The outcomes and feedback from students will be discussed, shedding light on the effectiveness of this pedagogical approach in preparing future engineers to address the challenges of sustainable material design.

4

Material sample as a design aid for material selection in the practice-based approach

Antoine Tour

PSL University, ED540 EnsadLab, Soft Matters Design Department

This poster presents doctoral research, in the field of design, which focuses on the classification of materials in the context of creating a library of physical materials. Selection methods such as the Ashby diagram are useful for materials experts and can be used to select materials early in the design process. But are these selection methods suitable for non-expert users? Given the diversity of training courses in fashion, applied arts and design in Paris area - corresponding to the future users of the materials library- we want to highlight a educationnal continuity on materials selection between these disciplines. In addition, the use of material samples enables a dialogue between the different actors involved in a design project, by providing both information and a physical representation of a material. We therefore suggest that the material sample is necessary to understand the material specification from the point of view of non-expert users(such as craftsmen, designers or architects), and we consider the physical material sample as a medium in the design process. Fig. 1. Data visualization presenting the future users - fashion, applied arts and design students in 2022 - of a material library in Paris area (thesis context). How is this medium used within a practice-based approach? Using a Material Driven Design methodology (Karana et al., 2015), we present how material sample can guide design and decision making through practice. And that material sampling has a positive impact on improving material knowledge in design practices. It is therefore necessary to rethink the sample as a generic form that compiles several layers of data representations and enables materials to be compared and selected on the basis of their sensory qualities and know-how. Fig. 2. Workshops with applied arts and design students, focusing on recyclability and waste, offering two approaches to understanding material specifications, through practice (experimentation). This research contribution focuses on how establish a material oriented language based on different user expertise across applied arts and design sciences, and ordered in a system of ranged samples.

5

Higher Education Classroom Of the Future. An ongoing EU-funded project on adaptive and immersive education integrating Virtual Reality and Artificial Intelligence

Andrea Marinelli, Francesco Iannacci, Flavia Papile, Maria Vittoria Diamanti, Mattia Sponchioni, Barbara Del Curto

Department of Chemistry, Materials, and Chemical Engineering "Giulio Natta", Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133, Milano (MI), Italy

Artificial Intelligence (AI) opens up bright perspectives for education. AI is capable of delivering a personalized learning experience through, e.g., deep learning, natural language processing, and adaptive learning. An AI-driven learning system can help students suggesting adaptive learning paths to attain learning goals, predict student performance, and recommend ways to improve. The combination of AI and Virtual Reality (VR) technologies can push the limits even further, thanks to their immersive nature, ability to offer virtual experiences on systems/environments not directly accessible by students, and potential to mitigate cost, or equipment barriers. AI can control and adapt VR to offer personalised experiences and analytics that provide profound insights into learning and behaviour.

The Higher Education Classroom Of the Future (HECOF) project aims to build a pedagogical model that integrates VR and AI for simulation-based learning. Through a co-design approach involving students, the project seeks to increase motivation and engagement. The HECOF system adapts to individual needs detected by AI algorithms providing support and educational measures that respond to adaptive education models.

The framework of the system includes:

- Theoretical lectures that integrate specifically designed learning loops for an optimized student experience.
- A VR-based immersive learning environment, available for synchronous and asynchronous access. It offers a problem-based laboratory activity on a bioreactor. The learners manage multiple process parameters to achieve specific goals, and experience real-time system changes simulating a process taking weeks in a real life environment.
- An online AI companion that tracks the learners' performance, generates evaluation quizzes based on the contents of the lecture, adapts to their individual needs, and enables collaborative learning by sharing notes and comments.

The HECOF system is expected to increase motivation and engagement among students. It fosters self-directed, self-disciplined, and self-monitored thinking skills, as well as improved communication and problem-solving abilities.

6

Development of a Materials Properties Chart Board Game

Asher Barnsdale[1], Joel Galos[2], and Bosco Yu[1]

[1]University of Victoria and [2]Cal Poly San Luis Obispo

Pedagogical literature indicates the potential effectiveness of gamified learning approaches in improving student understanding of fundamental engineering concepts. This poster presents a newly developed materials engineering board game. The objective of the game is to introduce engineering students to engineering materials, material properties and material selection through an interactive board game. Students are required to measure material properties (such as mechanical properties, thermal properties, electrical properties, and physical properties) of one inch diameter material balls and then subsequently rank the materials based on the measured properties to construct an Ashby plot on a wooden board. The board game allows students to get a visceral sense of how different materials feel and simultaneously exposes students to simplified material property measurement. Feedback from the community is sought on how to improve the board game and how to incorporate it into the classroom.

7 Enabling Resilience and Employability Skills in Capstone Projects

Rola Saad
Department of Electronic and Electrical Engineering, The University of Sheffield

In recent years, there has been a notable shift towards offering comprehensive support to university students to enhance their professional development, transferable skills, and employability. Central to this evolution are capstone projects, serving as a vital bridge between theoretical learning and practical application. These projects empower students to address the challenges of their future careers, reflecting their growth and mastery of essential skills and knowledge within their chosen fields. Therefore, within the Department of Electronic and Electrical Engineering at The University of Sheffield, efforts have been directed towards reinforcing the structure of capstone projects. This engineering education initiative discusses the latest advancements in coordinating, tutoring, and assessing engineering capstone projects, emphasising the enhancement of student wellbeing and the cultivation of employability skills. The focus is on fostering greater resilience, refining transferable skills, and strengthening teamwork abilities—crucial attributes in the dynamic and multifaceted realm of engineering. The presentation will showcase the structure of capstone projects at EEE and articulate effective strategies to empower students, showcasing their impact on student development and success. Findings suggest that well-structured tutoring support and clear guidelines for module deliverables have led to improvements in student wellbeing and interpersonal skills.

8 Identification of plastics with simple means and structured flow chart

Sebastian Limberg*; Dr. Steffen Ritter; Jonas Stratmann
Reutlingen University; Germany

Every day, billions of injection moulded plastic parts are produced worldwide. This makes particular sense, among other things, because the environmental performance of plastic parts in the vast majority of cases far exceeds many other solutions.

The production of state-of-the-art plastic parts and products requires material, process and technical know-how. All these aspects must be taken into account in order to achieve the best economic and ecological results for the respective development. Correct material selection is an important decision for moulded plastic parts. In most cases, better design and the right choice of material can prevent failures and significantly improve the parts. The exemplary analysis of existing plastic components is an essential learning resource to be applied.

Whether in packaging, electronics, clothing or construction - plastics play a crucial role. However, their wide range of applications and diverse properties often make it challenging to identify them at first sight. Modern well known analytical methods such as infrared spectroscopy, various chemical analyses and other technologies are nowadays used to identify plastics, but these methods are very complex and are not available to everyone.

A flow chart for identifying common plastics using appropriate simple analysis methods offers the opportunity to immerse yourself in the fascinating world of plastics identification. The aim is to familiarise participants with the basic principles of plastic identification and to enable them to identify different plastics independently with easy methods.

A clear and simple flow chart has been created to make it easier to identify plastics. This chart enables a systematic approach and a better understanding of the diversity of plastics. By combining theoretical knowledge and practical application, the ability to distinguish and handle plastics is specifically developed.

9 Updating Materials Science Education through Generative AI: A Novel Approach to Interactive Learning

Javier Orozco-Messana, Ana Maria Gonzalvez-Pons
Universitat Politècnica de València, Spain

This poster elucidates a cooperative initiative leveraging generative artificial intelligence (AI) to enhance the teaching and learning experience in the field of Materials Science. Traditional educational methods often face challenges in engaging students and conveying complex concepts effectively. Our research explores the integration of generative AI technologies to develop interactive and dynamic learning modules for Materials Science courses. By combining students from different nationalities and degrees in a transdisciplinary and multicultural environment was creating with relevant results. The poster will showcase the combination of a generative AI platform with real laboratory results designed to stimulate a group assessment of the experiment results, visualize the theoretical background of the assessment, and generate interactive content that facilitates a deeper understanding of materials properties and behaviours. Using natural language processing, machine learning algorithms, and 3D visualization, our platform aims provided an immersive and accessible learning environment for deep learning results based on joint discussions. Key features of the generative AI platform include adaptive learning pathways, personalized feedback mechanisms, and real-time simulations of materials-related phenomena. The poster highlights the platform's ability to cater to diverse learning styles, fostering an inclusive educational experience. Additionally, the incorporation of transdisciplinary debate is discussed, emphasizing the potential for increased student engagement and motivation. We will present the results of pilot implementations of the generative AI platform in Materials Science lab courses, showcasing feedback from students and educators. Evaluation metrics such as comprehension levels, retention rates, and overall satisfaction will be discussed to assess the effectiveness of this innovative educational approach. By embracing generative AI in Materials Science education, this research seeks to revolutionize the pedagogical landscape, making the learning process more interactive, engaging, and accessible. The poster aims to spark discussions on the transformative potential of generative AI in education and its broader implications for shaping the future of Materials Science instruction.

10 Experiences of teaching Technical Design Engineer bachelor students a Social-LCA assessment methodology related to early phase material selection

Plinio Fernandes Borges Silva, Peter Hammersberg, and Jonas Tuveson
Chalmers University of Technology

The field of sustainable development encompasses three fundamental dimensions: ecological, economical, and social. However, within the domain of materials science and engineering, the social dimension often receives inadequate attention compared to its counterparts. Despite ongoing efforts to classify specific elements or materials as critical, such designations are significantly influenced by economic and ecological considerations. Addressing this imbalance, Ansys presented an experimental plug-in during the 12th edition of the Material Education Symposium, which will be integrated into the Granta Edupack software in the future. This innovative tool follows the same early phase approach as EcoAudit does and serves as a simplified social life cycle assessment, emphasizing social considerations in materials selection. Primarily, the plug-in functions as a Microsoft Excel file, consolidating social assessment data from various institutions. Notably, it possesses a capability to identify and highlight detrimental social practices, termed as social hot spots. This presentation covers the experience of introducing and applying this experimental tool as part of the material selection methodology trained in a course on sustainable product design.The tool's efficacy was evaluated through its implementation in a technical design class at the bachelor's level, providing valuable insights into the potential benefits and drawbacks. The methodology employed in integrating the plug-in, the feedback garnered from students, and the experiences of the teachers involved form the crux of this discussion. By sharing these experiences, the aim is to contribute to the ongoing discourse on incorporating social dimensions into sustainable materials education, thereby fostering a more comprehensive and holistic approach to the field. There are videos, decision games, files..... but during the course the students have expanded their research capabilities and their knowledge in Materials Science.

11 Digital Manufacturing in Aerospace: Creating Project-Based Learning Opportunities for Aerospace Engineering Undergraduate Students

Shwe Soe, Lucy Corfield, Drew Williams-Hicks, Tamsila Tauqir, Joe Butcher, Carwyn Ward
College of Arts, Technology and Environment, School of Engineering,
University of the West of England, Bristol

This poster shares an education journey, on the development and delivery of a new course at UWE Bristol - Digital Manufacturing in Aerospace (DMiA) - deployed during the final year of BEng Aerospace Engineering (Level 6) at UWE Bristol. The course aims for the following Learning Objectives: (i) Critically evaluate manufacturing technologies, processes and performance for use within aerospace and other industrial sectors; (ii) Appropriately apply benchmarking techniques associated to design for manufacture; (iii) Critically evaluate design optimisation tools and approaches in developing complex and functional components, and; (iv) Identify and apply suitable process modelling strategies concerning process efficiency and part quality. The principal expectation of the course is to provide learners with detailed knowledge and practical skills for the development of personalised products and customised solutions; achieved through Project-Based Learning and Flipped Learning approaches, aiming to simulate real-life scenarios with group assignments. The poster will reflect on experiences within the course, including its opportunities and challenges, whilst sharing details of the course materials, practical sessions, and assessment framework. In particular, since the assessment is a group assignment, it is designed to be practical-led and research-oriented, meaning students' learning is facilitated with a range of 3D printers and other essential equipment supported by fully trained technical staff. Within School of Engineering, full accessibility of digital tools such as the ANSYS simulation software suite enables the students to appreciate digital manufacturing workflow, generative design principles, and Life Cycle Analysis. This is further supported in DMiA by subject-experts from the ANSYS Academic Development Team, and specialists from industry, who give a range of talks to the learners. Finally, the talk will share highlights from students' submissions and their feedback, and show how the course is regularly updated by mapping against other courses and the School of Engineering's Professionalism Portfolio Guidance.

12 Teaching of Machine Elements integrating CAD and CAE Software for a sustainable design in the Mechanical Engineering Career at FIUBA

Professors, Guillermo R. Facal, Carlos J. Gérez and Javier Mañe
Mechanical Engineering Department of the Faculty of Engineering of the University of Buenos Aires

Nowadays, Engineering Schools must adapt their curricula to the enormous technological challenges of the 21st century. The Mechanical Engineering program at FIUBA is not immune to these substantial changes. The teaching staff of Elements of Machines, of which the authors are its professors, aware of this change, have made changes in that direction since the 2nd semester of 2021. First of all, we implemented the resolution of exercises applying the KISSsoft Mechanical Design software from the Gleasson Group, Corp, and introduced images and videos of numerical simulations carried out with the ANSYS software in the class presentations, that helped our students to understand the concepts of complex engineering design. Currently, in the 2nd Semester of 2023, we incorporated into the practical works on shaft and gear design, which our students carried out with traditional calculation, and they could verify by using KISSsoft, and send the outputs to CAD systems. We expect that in the semesters to come they will also be able to perform this verification by Finite Elements with ANSYS software. All this software helps us significantly to explain the theories and formulas applied and the verification of results of the designs obtained by traditional methods in problems and practical work. For the future, we plan the incorporation of the ANSYS GRANTA to select materials for sustainable design, and the MATLAB software in order to improve our present results. The software used is academic software available in the " Laboratory of Design, Simulation and Manufacturing of Mechanical Elements" of the Department of Mechanical Engineering of the Faculty of Engineering of the University of Buenos Aires

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An interdisciplinary problem-solving approach to learning Materials Science

Rosita Bannert
The London Interdisciplinary School

Complex problems require interdisciplinary solutions. Solutions to the world's most complex and interconnected problems won't come from a single specialism or subject. We need to bring together experts and knowledge from across the arts, sciences and humanities. That's what we are doing at the London Interdisciplinary School.

The Materials and Making module at LIS teaches Materials Sciences alongside traditional making techniques, interacting with a wide range of materials. The brief on the course is to create a wearable item using materials sourced from within a 10 mile radius of the LIS campus, in Whitechapel, London. The final piece involves a scientific report with reasoning of material and design used, as well as a final prototype of the finished item.

The first 7 weeks of 10 involve hands on making experience from a variety of traditional and modern making techniques and using a range of materials. The second 3 weeks will be focused on designing and creating student projects, considering our problem or concept we are addressing. Students keep a sketchbook throughout and document discoveries and material experiences.

The process is both experimental as well as rigorous, using materials science data. Failures are necessary to learn the limitations of materials and manufacturing processes. Data will inform the material selection process, so analytical skills and mathematical proficiency are necessary. This course will ask students to push comfort zones, and be proactive and productive, analytical and inquisitive.

We'd love any feedback, ideas, or critiques from academics or makers attending the symposium, as we aim to expand and grow this course in the next few years.

Please email ***rosita.bannert@lis.ac.uk*** if you would like to reach out and connect.

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Physics for Sustainable Development in the Home: Using Criticality as a Measure

Meera Sheth
University College London

Criticality is the assessment of the risks connected with resource production, use and end of life [2]. It is an evaluation of the importance of a resource to specific technologies, or industries on a global or regional level [3]. There are many aspects to consider when evaluating the criticality of a raw material, such as the geopolitical, social, and ecological effects on the extraction, production and use of the material [6]. Many different methods to measure criticality have been developed by researchers, which consider the above factors. However, most studies have created a variety of 'indicators' which assess the extent of how different drivers impact the supply risk of a material, have assigned a weighting to each indicator and provided the method of gathering and measuring this data. Assessing criticality is an important aspect of product design and helps inform decisions on material choice, leading to more sustainable actions being undertaken. Physics can play a major role in assessing criticality since analysis on material composition, properties and performance can help evaluate the status of materials. Insights into criticality help to identify and manage risks associated with the use of critical materials and allow strategies which aim to reduce their use to be implemented [9]. Criticality assessments can be used to build resilience in the market to supply risks since it helps to identify them and evaluates the importance certain factors can have on the supply of a material and its impacts.

In this project, the main aim was to adapt an existing methodology to measure criticality in order to factor in indicators which have not been quantified and included in the past. Using the findings from the literature review, the best methods from popular studies were extracted and reconfigured to be included within this new framework. Different studies had different strengths e.g. Helbig et al. (2021) were great at specifying appropriate normalisation, whilst Graedel et al. (2012) suggested a good approach to aggregate all indicator values using a criticality matrix. The weighted sum of the indicators within each category will be calculated to give category scores as well as overall criticality scores. To visualise the contribution of each, the scores can be then plotted as a 3-D criticality matrix. The contribution of this aggregation of indicators is that the methodological steps are easy to follow and can be applied to evaluate a range of materials and case studies. This framework provides a toolkit to quantitatively assess criticality.

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Teaching materials science and modeling crystal plasticity

Kaitlin Tyler*, Jimmy He, David Mercier

Ansys

Striking a balance between a rigorous technical curriculum and the ever-evolving landscape of industry leaves many new graduates unprepared for the working world [1-3]. Some curriculum topics identified by recent engineering program graduates as lacking include practical examples and increased usage of technology and software in the workplace [1]. In a materials science curriculum, topics such as finite element analysis (FEA) and computational fluid dynamics (CFD) (industry standard simulation tools) are not commonly found. As a simulation software company, we at Ansys are aware of the impact simulation is and will have on the engineering world and understand how critical it is that all engineers, regardless of discipline, have awareness of these tools. So how do we include simulation like FEA into a materials science curriculum?

A place that we see synergy between industrial applications of FEA for materials science that could benefit academia is crystal plasticity modeling. Students learn about various characterization methods, such as Electron Backscatter Diffraction (EBSD) and how we can map grains, but how else could this data be used? A workflow has been developed to run a crystal plasticity analysis in Ansys Mechanical and PyMAPDL, which uses EBSD data as an input. While this application has been designed for industrial customers, we in the Academic Development Team want to explore its possibilities in the academic sector. In this poster, we will be showcasing the workflow and looking to discuss how these materials-heavy simulation applications could be used in higher education.

[1] Goold, E. (2015). Engineering students' perceptions of their preparation for engineering practice. The 6th Research in Engineering Education Symposium
[2] Alboaouh, K. (2018). The gap between engineering schools and industry: A strategic initiative. 2018 IEEE Frontiers in Education Conference (FIE), 1–6
[3] Spang, D. I. (2014). Curriculum design and assessment to address the industry skills gap. 2014 ASEE Annual Conference 38; Exposition, 24–345.

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Ansys Education Resources for STEM

Elisabeth Hülse & Kaitlin Tyler
Ansys Academic Development Team

With all the challenges facing the world today, engineers are more important than ever. A question that comes up often is how to we inspire the next generation to consider engineering as a career path. But with overly full pre-university curriculums, how are children supposed to engage with engineering before university[1], increasing their odds of choosing an engineering or STEM degree program? And this question does not begin to touch on the need for a diverse engineering population, which leads to questions of accessibility to engineering for minority groups (race, sexual orientation, socioeconomic status, etc.)[2–4]. This poster showcases a few of the efforts Ansys is making to support STEM education; we look forward to sharing and learning from everyone.

1. Godwin, A., Potvin, G., Hazari, Z. & Lock, R. Identity, Critical Agency, and Engineering Majors: An Affective Model for the Choice of Engineering in College. Journal of Engineering Education 105, 312–340 (2015).
2. Miner, K. N. et al. From “Her” Problem to “Our” Problem: Using an Individual Lens Versus a Social-Structural Lens to Understand Gender Inequity in STEM. Ind Organ Psychol 11, 267–290 (2018).
3. Skvoretz, J. et al. Pursuing an engineering major: social capital of women and underrepresented minorities. Studies in Higher Education 45, 592–607 (2020).
4. Cech, E., Rubineau, B. Silbey, S. & Seron, C. Professional role confidence and gendered persistence in engineering. Am Sociol Rev 76, 641–666 (2011

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Materials Informatics in Academia: Challenges and Opportunities

Wen Zhao, David Mercier & János Plocher
Ansys Office of the CTO

Teaching material informatics in academia presents several unique challenges. Firstly, the interdisciplinary nature of the field demands instructors to navigate through diverse subjects like materials science, data analysis, and computational techniques, requiring a breadth of expertise. Additionally, the rapid evolution of technology necessitates constant updating of course content to keep pace with emerging tools and methodologies. Limited access to specialized software and hardware can also hinder effective instruction. Moreover, bridging the gap between theoretical concepts and practical applications poses a challenge, as students must grasp both abstract theories and their real-world implications. Fostering collaboration between students with varying backgrounds, from engineering to computer science, requires innovative pedagogical approaches to ensure an inclusive learning environment. Overcoming these challenges requires continuous adaptation, collaboration across disciplines, and a commitment to staying at the forefront of technological advancements. Lastly, some examples of collaborative projects between Ansys and universities are given to illustrate how to overcome these challenges.

19 International Materials Selection Challenge

Harriet Parnell & Elisabeth Hülse
Ansys Academic Development Team

Engineering education thrives on strong curricula, but bridging the gap between theory and real-world application can be a hurdle. This competition provides a dose of exciting, hands-on innovation alongside undergraduate studies.

It allows students to:

- Amplify existing projects: In-class concepts come to life in the challenge's open-ended, industry-relevant problems.
- Fuel their passion for innovation: They're not just learning; they're competing alongside peers from all corners of the world. International participation fosters diverse problem solving approaches and global awareness.
- Master the art of practical application: Ansys software transforms into a virtual laboratory, where students test and refine their material choices. This hands-on experience builds confidence and bridges the gap between theoretical models and real-world implementation.

20 An Additive Manufacturing-oriented Design Approach: A Hip Joint Case Study

János Plocher, Navid Manai & Lakshana Mohee
Ansys Academic Development Team

A comprehensive exploration of additive manufacturing (AM) methodologies is presented by the proposed workflow in this poster, with a focus on the intricate design considerations within the context of hip joint fabrication. Delving into the identification of optimal material candidates, complex design optimizations, and meticulous addressing of thermal stresses and printing irregularities, the process highlights the meticulous attention to detail. Furthermore, the traceability and repeatability of results are ensured by a robust data management system, facilitating adherence to stringent qualification standards. Valuable insights to the broader domain of additive manufacturing are contributed by this study, which is not only advancing the field of biomedical engineering but also shaping perspectives within the domain.

A Technical Biography of EduPack

Nick Ball & Claes Fredriksson

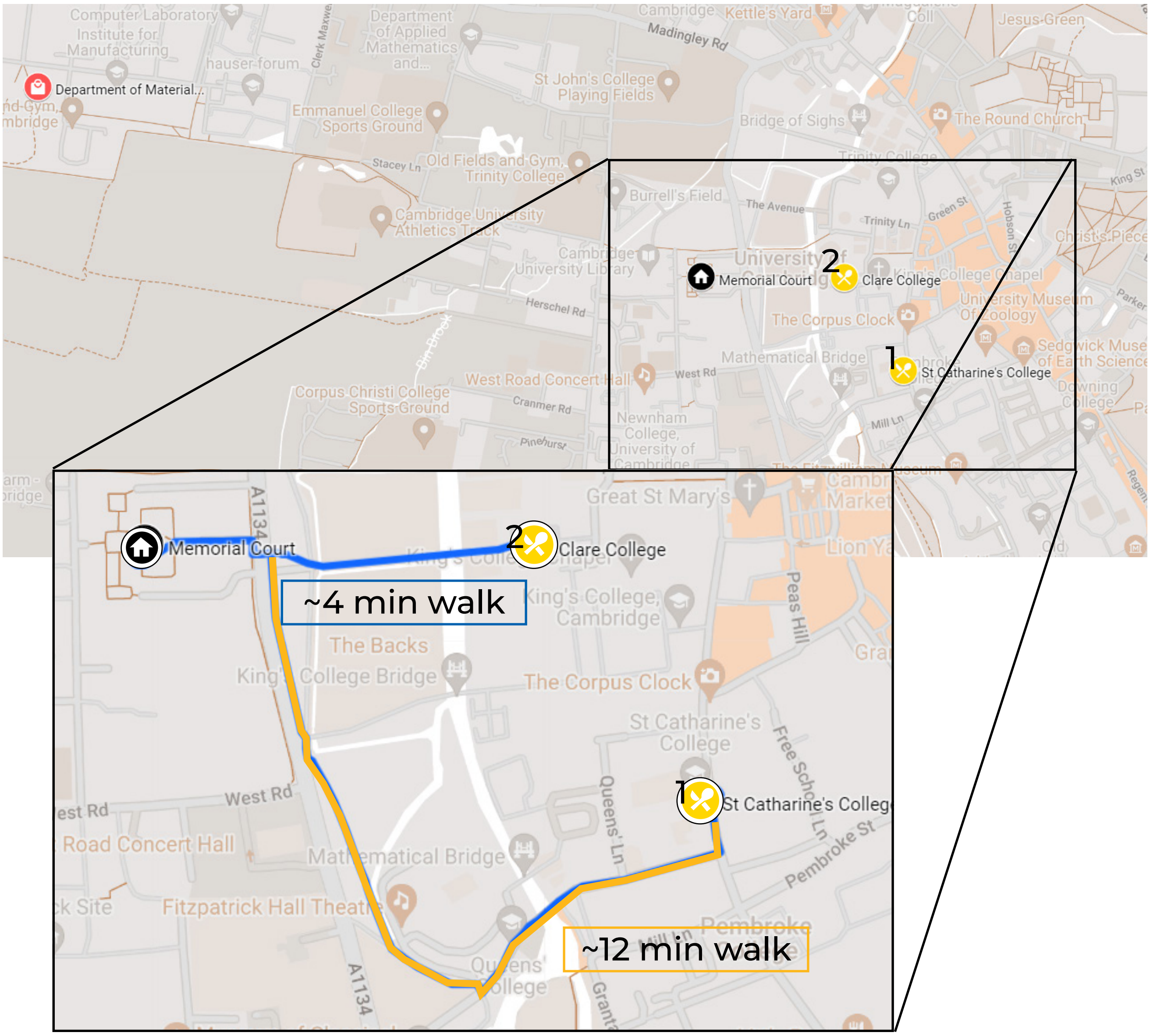
Ansys

Ever wondered how your favorite material-property creating software, Ansys Granta EduPack, got its start?

Come see our poster to learn the origins, the early evolution, and how Granta EduPack supports teaching systematic selection in the classroom.

Section 5: Maps, Contact Details, and Venue Information

Key Event Locations



Location	Address
	**Clare College Gillespie Conference Centre** (Symposium Venue and Accommodations) Memorial Court, Queens' Rd, Cambridge CB3 9AJ, UK
	**St. Catherine's College** (Presenters' Dinner- Invitation only!) Trumpington St., Cambridge CB2 1RL
	**Clare College** (Symposium Dinner Location) Trinity Ln, Cambridge CB2 1TL
	**Department of Materials Science and Metallurgy, University of Cambridge** (Workshop Location) 27 Charles Babbage Rd., Cambridge CB3 0FS

WiFi Access

To access WiFi while on the University of Cambridge campus, you can create a log-in here:

https://help.uis.cam.ac.uk/service/wi-fi/connect-uniofcam-guest

Event Location Details

Symposium Venue and Accommodations

The Symposium will be held at **The Clare College Gillespie Conference Centre** in the University of Cambridge.

Address: Memorial Court, Queens' Rd, Cambridge CB3 9AJ, UK

Directions:

- *From the rail station:* Cambridge rail station is about 1.5 miles from the College—a 10-minute taxi-ride, although it may take longer at peak periods (ask for "Memorial Court, Clare College"). For bus connections, take a bus to the city center.

- *From the bus station:* Cambridge bus station is about a 15-minute walk, or 5-minute taxi-ride (ask for "Memorial Court, Clare College") in clear traffic from Clare College.

- On arrival, report to the Porters' Lodge at the Memorial Court.

Workshop Venues

The workshops on Wednesday, April 3rd will be at the Department of Materials Science and Metallurgy in the University of Cambridge

Presenters' Dinner

The presenters' dinner will be hosted at St. Catharine's College. Invitation only!

Address: Trumpington St., Cambridge CB2 1RL

- Pre-dinner drinks will start at 7

- Dinner will be served in the Dining Hall

Symposium Dinner

The symposium dinner will be hosted at Clare College

Address: Trinity Ln, Cambridge CB2 1TL

- Pre-dinner drinks will start at 7

- Dinner will be served in the Dining Hall

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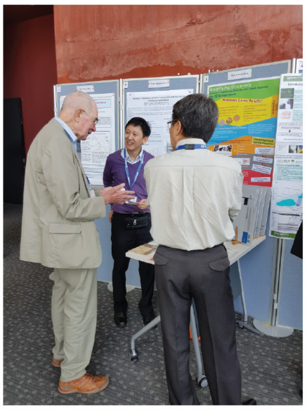
Materials Education SYMPOSIA

ASIAN MATERIALS AND DESIGN EDUCATION SYMPOSIUM 2025

hosted by NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE in collaboration with Ansys

First Materials Education Symposium to include "Design" as a key component

Tentative date: January 2025



More information coming soon!

Interested in learning more information?
Email the team at education@ansys.com
or check out:

www.materialseducation.com

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