National symposium: Developing socially responsible STEM professionals

A report on the second national symposium
Hosted at City, University of London
12 January 2021

Sponsored by
City, University of London in partnership with Engineers without Borders UK, hosted the second symposium on “Developing Socially Responsible Professionals in STEM careers”, or SRP in STEM, on 12 January 2021.

Engineering, computer science and science-based occupations are already deeply connected to social and environmental responsibility, although the formality of how “SRP” subjects – such as diversity, ethics, sustainability, social value initiatives, data privacy – are taught in STEM curricula vary widely. Since our first event in 2020, I have learned of many more activities and initiatives run by organisations such as the Royal Academy of Engineering, British Computer Society, the University of Exeter, Money4YOU, Diversity by Design and the Worshipful Company of Information Technologists and more, that work to improve the understanding of social responsibility in STEM learning. For example, The Engineering Council updated its statement of ethical principles for engineers in 2017, with four key parts: 1. Honesty and integrity 2. Respect for life, law, the environment and public good 3. Accuracy and rigour and 4. Leadership and communication. Working with bodies such as the Royal Academy of Engineering, the Council is trying hard to instil these ethical principles in engineering course curricula (page 12).

This year our partner in SRP in STEM is the charity Engineers Without Borders UK. Its purpose is to galvanise the engineering community to serve all people and the planet better than ever before. Their head of engineering, Emma Crichton, said The Lancet Planetary Health reported we are not meeting the basic needs of all people, including water, food, health, education, energy, gender equality, social equity and more. And the opportunity for STEM professionals to help achieve these goals, to have a sustainable and fair world is huge. But action is happening. An Engineers without Borders UK changemaker, Maryam Lamere, graduated in Aeronautical Engineering from City in 2010. She created an engineering network to pool experiences of engineers in social and environmental responsibility and she now coordinates the Engineering Without Borders UK: Engineering for People Design.

Computer science is also an area that needs more teaching and exchange about social responsibility. New technology like consumer data capture, facial recognition software and surveillance cameras are encroaching on people’s rights. The British Computer Society’s Computers in Schools programme tries to attract children into computer science careers by saying that “solving problems is fun” rather than asking “Do you want to be in IT?”, showing that communication is key to delivering the solutions.

I am grateful to all the speakers and presenters who took part in the event. I hope you find the report useful. Please contact me about your work to promote SRP in STEM professions and let us work together to make STEM careers with for society, fairness and the planet.

Yours,

Professor Rajkumar Roy
Dean of School of Mathematics, Computer Science and Engineering
City, University of London
Defining the problem

Sir Ken Olisa OBE
Founder, Restoration Partners

“The importance of STEM has become a matter of public interest like never before.”

Definitions are vital. Problem solving needs terms, in this case it is STEM and social responsibility.

- STEM vs STEAM – Science, Technology, Engineering, Arts and Maths – are not the same thing. STEM is easy to define while STEAM is far too broad to be meaningful in the same way.

- The definition of social responsibility is having a duty to act in society’s best interests.

- The general public is largely oblivious to the importance of STEM, as the operation of engineered things like buildings, cars and trains is simply taken for granted. We were liberated from worrying about how things work by being able to turn them off and on again.

- In 2020 the UK was subjected to three great tests: Covid, BLM (Black Lives Matter) and Brexit. Respectively, they tested our health and economic systems; our consciences; and our nerves while showing that everything is connected. As a result, the importance of STEM became a matter of public interest like never before.

- As evidence:
  - BLM brought global attention to a subject that spanned archaeology to theology.
  - The Chief Medical Officer and the Chief Scientific Officer have never had millions of social media followers before and the government has resolutely claimed to be led by the science.

- What does social responsibility mean in the context of STEM professionals? Contrast the experiences of the Covid vaccination programme with Boeing’s engineers behind the 737 MAX disasters or Grenfell Tower’s technical supervisors. Were they incompetent or negligent?

- Back to definitions. Responsibility means “taking the blame” and “acting in the public interest”. It is important to focus on the latter.

- What do we have to do to make sure that our STEM professionals are socially responsible?

- Answer – they need to act as professionals. True professions are ruled by a code of conduct and must act in the best interests of all the public, as a result, ensuring that inclusivity (and therefore access to a wide range of lived experiences) is paramount.

- As an example, my professional body - Chartered Institute of Information Technology defined our code of practice at the core of a profession with any member in breach of it risking being struck off the register and therefore losing their license to work.

- For STEM professionals to be socially responsible requires three things:
  1. Professional bodies are not trade unions. They must prioritise public duty over their members’ interests.
  2. Governments should introduce policies which ensure that access to a professional career depends on talent and not privilege.
  3. The public (aka the customer) must hold professions to account and call out poor practices.

Watch Ken’s full presentation here: https://www.youtube.com/watch?v=6uy63CZ_WJw&list=PL-fOTatkP4gHZFRpBrTHthrh8DkXUQ72f&index=3
Sustainability
The Circular Economy

Fiona Charnley, Associate Professor, Co-director of the Exeter Centre for the Circular Economy, University of Exeter Business School

Key points

• 1924 the world’s biggest lightbulb manufacturers decided to limit the lifespan of lightbulbs to 1,000 hours, to avoid losing money on bulbs that typically lasted twice as long.

• This epitomises the transactional or linear economy that depends on an ever-increasing pattern of consumption, leading to increasing draws on our natural resources. Once consumed, products in this system typically are sent to landfill.

• The circular economy is an alternative model and asks us to consider what we mean by value and wasted value.

• People tend to think of recycling as a solution. In the circular economy we consider recycling last and try to remain in the “inner loops” of the circular economy – maintenance, refurbishment and remanufacture – keeping products at their highest value, before they are recycled, because recycling is resource intensive.

• 100,000s business, including Google, are now implementing the circular economy at the heart of their business strategy. UKRI, the government’s research agency, has invested £30 million into circular economy research across five centres of excellence and a coordinating CE-Hub, being led by the University of Exeter.

Skills that STEM professionals need to drive the circular economy

• Case study: Notpla – Start up that created plant-based material to replace single-use plastic. Edible and biodegrades in six weeks. It produces 5x less CO₂ and is cheaper than the plastic alternative.

• There are more refurbishment and remanufacturing stories from Philips, gNappies and Riversimple on Fiona’s presentation on YouTube. Caterpillar and Renault are among many companies creating new revenue streams from remanufacturing.

• The Exeter Centre for the Circular Economy helped Australian company gNappies develop a business model to produce a high quality fertilizer as a valuable bi-product of the used nappies.

• Riversimple leases 100% of its hydrogen powered cars and is the only car manufacturer whose model is never to sell a car. By running the leasing model through the car’s entire supply chain, back to the platinum miner, all stakeholders have an incentive to provide durable, high quality product and keep the car in service permanently.

• STEM professionals in the circular economy therefore need skills including engineering, sustainable design, business model design, digital technologies, understanding of how the circular economy differs from the traditional linear, consumption economy, and more. Circle Economy is a Netherlands released a report on jobs in the circular economy and the opportunities that circularity presents to the labour market.

Watch Fiona’s full presentation here: https://www.youtube.com/watch?v=2Tlmwcr2d24&list=PL-fOTakP4gHzFRpBrTHthhh8DkXUQ7ZfI&index=4
Developing socially responsible STEM professionals

Quality education (SDG4) as a catalyst for sustainable and inclusive growth

Maria Alexiou
L.L.M. International and European Law, Human Rights and Civil Liberties and ESG Senior Advisor, TITAN Cement International, Greece

Key points

• CSR is 30-years old but it has not delivered the objectives that it set out to, considering the potential assistance of globalisation and Industry 4.0. The differences in the quality and the way we operate CSR in every country is a key point.

• From the United Nations Global Compact in 2000 we moved to the adoption of the UN Global Goals 2030 in 2015 having identified 15 global trends that are shaping all our futures. These are:

  1. Planet under pressure
  2. Limited resources
  3. Energy transition
  4. Future demographics
  5. The growing wealth gap
  6. Employment under pressure
  7. Next generation
  8. Local is king
  9. Fragmenting power
  10. Deteriorating security
  11. The rise of the city
  12. Hyper transparency
  13. Internet of Things
  14. Sustainable business
  15. Radical innovation

  • We need to use the dialectic relationship between people, nature and society to understand how our decisions influence each other and how decisions influence the future.

  • The good news: We have more scientific evidence than ever, better understanding of complex, non-linear systems, disruptive digital technologies and social entrepreneurship to drive this.

  • Stakeholder capitalism: under this the company is more than an economic unit generating wealth. Companies exist to serve human needs as well as make profits.

  • Because cement is the second most consumed material in the world after water, having a sustainable global cement industry is fundamental for society.

  • Businesses are made to serve the needs of humanity and need to do that by safeguarding harmony with nature and balance between current and future needs, material and non-material ones.

  • As in the case of construction, it is “affordable housing with resilient and sustainable products” that STEM professionals with relevant sustainability and CSR skills will need to address and resolve, with the best solutions.

  • STEM: Do we have the skills and the competences we need?

    • There are six key skills in addition to formal STEM training that people need so they can deliver CSR goals:

       - Teamwork
       - Creativity
       - Critical thinking
       - Problem solving
       - Conflict understanding
       - Conscious acting.

       The last is important because a lot of negative impacts come from our passive approach to problems. STEM professionals must be conscious to take actions and understand the impact of inaction.

       • The implementation of the SDGs 2030 is our chance to shape the future together and for the benefit of future generations. Education and SDG4 are recognized as critical for this along with partnerships and collaborations as indicated by SDG17

Watch Maria’s full presentation here: https://www.youtube.com/watch?v=OPGpSstwpE&list=PLfOTakP4qH2FRPbVRTHthrh8DkXUQ72f&index=15
Ethics
Turning ethics into ethos

Professor Colin Turner, Ulster University and President of the Engineering Professors Council (EPC)

“Until you make the unconscious conscious, it will direct your life and you will call it fate.”
Carl Jung

Key points

• UK SPEC is the UK standard for professional engineering competence. Its most recent edition has changed Section E, Professional Commitment. The improved edition gives a more explicit understanding of engineering ethics for engineers to fulfil their duties in an ethical manner.

• Ethics in engineering intersects with equality, diversity and inclusion (EDI). The EPC wants to see EDI as a natural aspect of STEM professions. Engineers have evolved to instinctively see through a health and safety lens; it must become second nature to include ethnicity and gender in that lens too. For example, are tyre wrenches made with long enough handles for the average woman to use?

• A shift from emphasis on “safety only” to Health, Safety and Wellbeing is preferable. This is important to build trust outside the engineering profession and a broader focus on better lives for all.

• Truth: People seek the single truth to simplify our lives but we have to broaden our perspective to incorporate opinions, political and philosophical factors.

• 2020, trust and error: Mistakes were made in managing the covid-19 pandemic so people are asking why errors should be tolerated and who to blame. This affects trust. Engineers need to consider not just the technical but the ethical and philosophical aspects of their work and knowledge.

• Colin says there is a creeping diminution of trust between STEM and the public and society.

• Exponential systems are at their heart unsustainable. We know that many of the things society is doing are likely to increase the probability of pandemics and climate change. Ethical choices are impacting on our survival.

• The rise of social media has raised ethical issues, such as generating and spreading fake news. We have to learn the lessons from this.

• Ethics and sustainability are closely related. We need to consider the role of social media in the propagation of trust, truth and science. People have strong views about how Twitter is censored or not.

“Until you make the unconscious conscious, it will direct your life and you will call it fate.”
Carl Jung

Going forward: Engineers must think about the ethical consequences of their work; it is easy to be beguiled by the technical only. Professional bodies like the Engineering Council and RAEng are working on this.

• Society and engineers need to openly and honestly discuss the role of error in STEM and understand it is a part of the process.

• Education of STEM professionals must not only focus on the narrow, technical and cerebral aspects but they understand the social and ethical aspects too.

Watch Colin’s full presentation here: https://www.youtube.com/watch?v=Mmfwv-svEAQ&list=PL-fOTakP4gHZFRpBvRTThrh8DkXUQ72f&index=7
Fostering ethical awareness in STEM professionals

Charles Fleddermann  
Professor of Electrical and Computer Engineering and Associate Dean, School of Engineering  
University of New Mexico

Key points

• Charles authored a popular textbook on Engineering Ethics, now in its 4th edition

• Ethics education for STEM professionals in the US can be divided into two areas: 1) Ethical issues that practicing engineers encounter in the course of their professional practice, such as honesty, how to avoid conflict of interests, handling intellectual property and fairness. 2) Societal implications of engineering, including safety, sustainability and the environment, and the global impact of engineering.

• Special topics in engineering ethics include: Computer ethics, Research ethics, Artificial intelligence, Privacy and Whistleblowing. The last is for people trying to prevent illegal or unethical behaviour in their organisation.

• The drivers for ethics education in the US are accreditation requirements, directed under the body ABET, and licensure requirements for practicing engineers. ABET identifies a set of educational outcomes that undergraduate students have to complete. In the US educators are required to have identifiable places in the curriculum where ethics is discussed and they must measure if the students understand this.

• Almost every state in the US requires evidence of ethics training when a professional engineer renews their licence.

• The overall goals of ethics training in the US are to sensitize students and STEM professionals to ethical issues they might encounter in their practice and provide tools for analysing ethical problems.

• All the professional societies have professional codes of ethics, they promulgate these codes to help professionals understand what their obligations are and to serve as guidelines when they encounter ethical problems.

• Professionals like to use case studies to embed knowledge about ethics. For example how politicians decide which group should be first to receive the Covid-19 vaccine.

• A good case study is that from the IEEE, the electrical engineers body, which has written ethics for Artificial Intelligence. These include human rights, accountability, transparency and AI technology misuse. Engineers have recognised that AI is a very important ethical issue that we need to discuss now. This illustrates the need for ethical thinking by STEM professionals.

Watch Charles’ full presentation here:  
https://www.youtube.com/watch?v=8gTrIsspXbd&list=PL-fOTakPr4pHzFRpDvRThrh8DkXUQ72f&index=13
Social impact initiatives

AmickyCarol Akiwumi MBE
CEO, Money4YOU

Key points

- Socially responsible professionals can be developed through social impact initiatives
- Carol comes from an entrepreneurial family and from an early age learnt to value making money and cutting deals, especially to solve pressing social problems. She is often inspired when someone tells her that something cannot be done.
- She founded Money4YOUth (now Money4YOU) in 2014 to equip young people from marginalised communities with financial literacy skills as well as knowledge and confidence for entrepreneurship.
- She was the founding chair of Black Fundraisers UK (BF-UK), a Special Interest Group of the Chartered Institute of Fundraising) from 2013 to 2018.
- During this time the dual pressures of a recession and a hostile political environment made Black fundraisers’ work very challenging. A report by Voice for Change England in 2015 predicted a decline of 25%-28% in the BAME voluntary and charitable sector compared with just 5% for mainstream charities.
- Then and now, there are very few BAME charities in proportion to the BAME population and they are severely underfunded. They are 20 times more likely to fold in their first decade of existence than their mainstream counterparts.
- Over the years, Carol and her team began to run fundraising events and training workshops, including a Dragons’ Den style event between grant holders and BAME non-profits. AmickyCarol was driven to educate funders about the specific needs of BAME communities.
- Carol Ossai founded Sickle Cell and Young Stroke Survivors. By 2016 the challenges of fundraising meant she was ready to fold the charity. Sickle cell anaemia effects people of Afro-Caribbean heritage.
- AmickyCarol secured funding from the Tudor Trust for a two-year pilot project called the AVOCADO Accelerator Programme. She knew she needed to do more than run workshops to help BAME charities survive and thrive. A key part of the challenge was to train charities to present the whole package, a full business model, to look attractive to funders. Carol Ossai graduated from the programme with distinction in 2018 and won the Most Improved award. By 2020 she was voted chair of the Global Alliance of Sickle Cell Disease Organisations (GASCODO). Sadly, Carol died in 2020 of covid-19 related complications but her organisation continues to support some of the most vulnerable members of society, because of the support received during the programme.
- Money4YOU’s AVOCADO+ Accelerator Programme is a prime example of a social impact organisation that is creating real value.
- Each participant has a consultant attached to them to support their organisation’s journey to resilience, operational excellence and funding sustainability.
- 26 interns from City University’s School of Maths, Computer Science and Engineering recently worked with seven BAMER-led non-profits, supported by Money4YOU, to deliver solutions to web development and database challenges. Students receive real-life experience of solving technology challenges for a business-driven charity or social enterprise. Many non-profit organisations lack capacity and are resource-poor so appointing STEM students to them is a huge benefit.

AmickyCarol says every social impact initiative needs:

1. Action – that is consistent and committed, at all levels, especially leadership.
2. Accountability – Be transparent. Make your KPIs, progress and failures public. Show where every pound is spent
3. Ambition – Aim high. Make your initiative equitable and accessible. It might cost more money but it will be valued and make a real difference.

Carol can be found on socials @AmickyCarol

““The future of socially responsible STEM professionals needs action, accountability and ambition.””

AmickyCarol Akiwumi

Watch Carol’s full presentation here: https://www.youtube.com/watch?v=wDIln8Ojnss&list=PL-fOTakP4gHZfR9pBvRHthhrh8DkXUQ72f&index=5
The failure of Corporate Social Responsibility

Professor Bobby Banerjee  
The Business School, City, University of London
Bobby has spent 25-years studying CSR. He presented his conclusions first.

Key points

- CSR is a misguided virtue. It is dangerous to expect corporations to solve the social and environmental challenges we face.
- CSR only focuses on win-win situations which is about corporations doing well by doing good. If that is how CSR is framed then there is a profound limit to how much good any corporation can do.
- The corporation in its current form is an inappropriate agent for social change.
- In a neoliberal political economy the social problem is not the anti-social effects of the economic market but the anti-competitive effects of society.
- The problem with CSR is there is too much focus on C and not enough on S and R. Much of the research has focused on the benefits of CSR for corporations and not the benefits (or harm) to the recipients of CSR initiatives.
- CSR has become an ideological movement intended to legitimize and consolidate the power of large corporations.
- In the case of mining operations in the developing world, CSR can be deployed as a weapon to circumvent legislation, undermine local resistance and even drive the active collusion of the armies and police in those countries.

More than 60-years research on CSR has focused on win-win cases: does CSR lead to better financial outcomes for the corporation?
Bobby says this seeks to answer the wrong question: is it profitable to do CSR?

The correct question should be: What are the conditions in the political economy that allow corporations to accumulate wealth at the expense of social and environmental welfare? i.e. the win-lose argument. And also: How can corporations be governed to prevent social and environmental damage?

- Among the definitions of CSR, the recurring themes are discretionary and voluntary, not compliance. The research on CSR really exposes how it benefits the corporation and there is very little on the outcomes of CSR for society.
- There are two main dialogues about the role of CSR in companies, 1) Efficiency maximisers. CSR must be done to serve the company’s goals which are invariably to increase its profits, and 2) Legitimacy; a force for good. Corporations have an enduring capacity to operate on the basis of civic virtue.
- The problem is that the legitimacy route is often defined by economic efficiency criteria.
- Usual suspects: often companies that do not have an ostensibly strong role in society and the environment profess to strong CSR and corporate governance. These include environmental polluters, weapons companies and tobacco companies.

Bobby provided some quotes of senior executives of such companies that claim to observe strong ethics and values-based culture that demonstrates integrity and honesty, when evidence showed their activities had a damaging effect on local communities.

Watch Prof. Banerjee’s full presentation here: https://www.youtube.com/watch?v=xhndprK2lb8&list=PL-fOTakP4gH7FrpBvRTHthrh8DkXUQ72f&index=6
Education

i) STEM professionals
Are they equipped to tackle global challenges and is this a priority in their education?

Emma Crichton CEng MICE
Head of Engineering, Engineers Without Borders UK

Engineers without Borders UK is a charity with a purpose to engage and galvanise the engineering community to serve all people and the planet better than ever before.

Key points

• The December 2020 edition of New Scientist by Simon Baron-Cohen, a psychologist at the University of Cambridge, said that about 70,000 years ago the human brain developed two critical circuits for innovation. This helped move us from using rocks to break bones to tool-making and eventually inventing music, maths and the wheel.

• The two critical circuits in the brain are empathy and pattern seeking.

• Empathy is a core part of how we create solutions, to meet the needs of people and our planet.

• The other critical circuit is pattern seeking; our ancestors used this to discover that if a hammer hit a nut it would produce a reward. Doing it again repeated the reward. Many algorithms are based on this “if-and-then logic”, also called systemising.

• Baron-Cohen said our brains either have a bias towards the pattern seeking or empathy side. Engineering tends to have a bias of people with pattern seeking rather than empathy, but professional engineers really need both to produce solutions that work for society. “We must consider empathy as essential to our process of innovating.”

• Emma presented some real case studies from when empathy has been missing. For example, facial recognition tools have inbuilt racial bias.

• Technical expertise is essential, but globally responsible engineering comes from a point of empathy, and that’s the key to creating long term sustainable and equitable solutions.

• Evidence for a rethink to ensure this is prioritised and being taught effectively in education.

• Doughnut economics, from Kate Raworth and Christian Gunter at The Lancet Planetary Health: We are not meeting the basic needs of all people, including water, food, health, education, energy, gender equality, social equity and more.

• We know the ability to generate and navigate innovative solutions, but the problem is we do not have the resources or structures to scale effectively

• Is social responsibility a priority in our education? Emma says not yet, drawing from reports, research and students’ testimonials. The RAEng’s Engineering Capacity Review 2020 said “In many countries, engineering students have few opportunities to apply theoretical concepts learned in the classroom.”

• But there is hope: An Engineering Without Borders’ Changemaker, Maryam Lamere, graduated in Aeronautical Engineering from City in 2010. She created an engineering network to pool experiences of engineers in social and environmental responsibility and she coordinates the Engineering Without Borders’ Engineering for People Design.

• the Engineers Without Borders UK’s Engineering for People Design Challenge is influencing change by enhancing education, shaping the engineering profession and collaborating globally.

Watch Emma’s full presentation here: https://www.youtube.com/watch?v=AsvGPyw01YI&list=PL-fOTakP4gHZFRpBvRThhrh8DkXUQ72f&oindex=9

Post-event update: Since the conference in January 2021, we are pleased to announce a 3 year strategic partnership has been formed between City and Engineers Without Borders UK aiming to embed Social Responsibility into STEM education at City. Find out more here: https://www.ewb-uk.org/city-university-of-london/ If you are interested in finding out more about Engineering without Borders’ work, to embed global responsibility into the heart of engineering, please contact https://www.ewb-uk.org/
ii) Socially responsible STEM professionals in computing

Adam Thilthorpe, British Computer Society

Key points

- Adam discussed how the aspirations of these professionals could shape the world we want to live in in the future and what is the burden of that aspiration.

- Adam asked what is our job as engineers, IT and computer scientists? It is to make good on the promise of digital technology, IT and science.

- STEM professionals bring critical thinking, which moves us away from unintended consequences. Hope without critical thinking is naivety but critical thinking without hope is just cynicism.

- IT and the internet are great inventions that are intended to solve the world’s problems, but there are unintended consequences because we have not thought about what it might do for society, we just got excited about the tech.

- The BCS worked with the Children’s Commissioner on a study that found 40% of 11-year olds in London have had exposure to sexual content. The primary vehicle for this was Instagram, a consequence in vast contrast to their company mission statement.

- BCS believes that everyone should have the opportunity to study world class computer science in the UK. It believes that every child that leaves school should be digitally literate. BCS as part of a consortium has rewritten the curriculum for computer science in schools.

- Doctors diagnosing patients on video calls has grown exponentially, but this is not making good on the promise of digital technology. We should aspire to use artificial intelligence to help improve the accuracy of remote diagnostics.

- Government is not good at sharing governing. In the pandemic when the NHS asked for volunteers a large number of people volunteered but there was no agile process to utilise this huge free resource, because government operates on a command-and-control model.

- Social media channels have enabled people to communicate with and help neighbours and friends through the pandemic, so perform a social good.

- But beware of labels: Platforms describes something that is agnostic, but Facebook is not a platform but an advertising monopoly. By addressing it in these terms, it changes the relationship we have with the platform.

- Adam said we need a debate about public space in the digital age. Can a person in a public role block someone when in a true public space, citing the example of former US President Donald Trump and Twitter.

- Any company claiming it is designed to make the world a better place needs to be asked two questions: i) in what timescale and ii) for whom? IT people get excited by the technology but they need to understand the societal context in which they operate. Adam said this is reason why Google’s staff are unionising.

- Ubiquitous technology usage: If all police forces use AI and facial recognition that changes the fundamental nature of my relationship with society. “I become a yet-to-be convicted criminal rather than a public citizen.”

- He summarised: How should the education that we provide need to change to so that we make good on the hopeful promise of science, engineering and digital for making the world a better place for everybody, rather than unintended consequences and nefarious applications.

Watch Adam’s full presentation here: https://www.youtube.com/watch?v=KFJuj9eB1nM&list=PL-fOTakP4gHZFRpBVThhrh8DkXUQ72f&index=11
iii) What do we want from our future engineers?

Dr Rhys Morgan,
Director, Engineering and Education, Royal Academy of Engineering

Key points

- The Royal Academy of Engineering’s strategic goal for the next 5 years is to harness the power of engineering to build a sustainable society and an inclusive economy that works for everyone. All the RAEng’s current activities focus on these two issues.

- The Engineering Council updated its statement of ethical principles for engineers in 2017. The four key parts are: 1. Honesty and integrity 2. Respect for life, law, the environment and public good 3. Accuracy and rigour and 4. Leadership and communication

- The Veracity Index 2020 measures public trust in all professions. Engineers score third on the list with public trust of 89% and scientists are sixth with 82%. ‘Politicians generally’ scored just 15%.

- But there are an increasing number of high profile failures involving engineering, including the Grenfell Tower fire disaster and the Boeing 737 MAX fatal accidents.

- The Engineering Council and RAEng established a new Engineering Ethics Working Group in 2019 to raise the profile of ethics in the profession, aimed at steering our community towards a higher culture of ethical behaviour, including raising the profile of ethical engineering practice among the public, government and the profession.

- What would good look like? It is about having the highest ethical standards in the world and have ethics engrained as a culture in businesses, in the same way we see health and safety embedded today.

- Engagement with society and education are at the forefront of what needs to be done to achieve this.

- MIT analysed a comparison between what engineers learnt at university and what they used in their profession. It found they mainly learnt technical areas of engineering such as materials mechanics, fluid mechanics and thermodynamics, but they learnt very little engineering skills and behaviours in their degrees, such as systems thinking, teamwork and communication. When asked what they use in their work, they found engineers used very little of the fundamental technical knowledge and much more of the engineering skills, behaviours and business skills.

- The RAEng suggests we might change the undergraduate curriculum to include more of these softer, business-led skills.

- The RAEng is looked at what influences the success of an engineering project and when in the process. The current focus on engineering education, like calculations, happens much later in a project’s success.

- Rhys suggested flipping the focus of engineering degrees, so economic, social, legal, ethical and environmental factors are prioritised over engineering analysis and mathematics. This is supported by Prof. Tim Ibell, chair of the Joint Board of Moderators that provides oversight of training standards in civil engineering.

- Professor Ibell has listed a new set of priorities and outcomes for engineering education, with much more emphasis on creativity, empathy and communication skills.

- Rhys said we should inculcate lifelong learning within engineers’ training as they cannot possibly learn everything they need to know in 3-4 years.

"If climate change is the most important thing facing humanity for the next 50 years, then it absolutely must be the driving heart of an engineering degree programme.”

Watch Rhys’s full presentation here: https://www.youtube.com/watch?v=01dvcQ8U0h8&list=PL-fOTakP4gHZfRbBvRThnhhBdXUQ7fI&index=12
Diversity

Simon Fanshawe OBE, D.Univ

Simon founded Diversity by Design, which uses diversity as a talent strategy to make businesses and organisations more effective.

https://diversitybydesign.co.uk/

Key points

• Simon talked about “Deficits and Dividends”, and that there are two main focuses for social responsibility:
  • The first is Towards opportunities
    • The first is Towards opportunities
      • The STEM workforce has a lower share of female workers (27% vs. 52%) and disabled people (11% vs. 14%) than the rest of the workforce.
      • The share of ethnic minority workers in STEM is on a par with the rest of the economy, as a result of workers with Indian ethnicity being more likely to work in STEM than elsewhere. People of other ethnic minorities tend to be under-represented in STEM.
      • Disabled people of all ethnicities are underrepresented in the STEM workforce.
      • Who is responsible for the pipeline of diversity? Simon said schools are doing OK; universities, not so bad; but industry is “pretty terrible”.
      • And who’s responsible for retention (environment/salaries/permanent contracts)
    • The second is Towards the science – The quality of science
      • Data bases/ Algorithms
        • 2016 an MIT researcher, Joy Buolamwini, studied Gender Shades in facial recognition and concluded that “When we analyze the results by intersectional subgroups - darker males, darker females, lighter males, lighter females - we see that all companies perform worst on darker females.”. If the person in the photo was a white man, the software was right 99% of the time. But the darker the skin, the more errors arose, to the extent that their sex was misidentified in up to nearly 35% of images of darker skinned women.
        • Algorithms for facial recognition were estimated to be more than 75 percent male and more than 80 percent White.
        • Researchers at the Georgetown Law School, also in 2016, calculated that, while 117 million Americans were in facial recognition networks used by the police, African Americans were most likely to be singled out because mug-shot databases had been used in which they were disproportionately represented due to the high level of arrests of black men.
      • NORMS – the partial projected as universal
        • When Siri was launched it could, according to Caroline Criado-Perez, find ‘prostitutes’ and ‘Viagra suppliers’ but not ‘abortion providers’. It understood ‘heart attack’, but if you were a woman who had been raped and told Siri, she replied – despite her artificially generated female sex – “I don’t know what you mean by ‘I was raped’.”
        • Caroline showed that in a car crash “women are 47% more likely to be seriously injured than a man and 71% more likely to be moderately injured”. And why is this so? For the simple reason that the design of crash-test dummies is based on the male body. But men and women are anatomically different in a number of very significant ways
        • Both questions come down to what you value in those you want to recruit. What kind of researchers are you trying to produce?

“Being ‘socially responsible’ in STEM is not a question of scientists just being ‘clever’ enough. What creates great science is the combination of differences in background and personal experience that people bring to, and combine in the pursuit of, innovation and discovery. I am tempted to argue that we should value the personal more than the technical so that science serves the whole population.”

Simon Fanshawe OBE

Watch Simon’s full presentation here:

https://www.youtube.com/watch?v=6X6j8egv9o8&list=PL-fOTakP4gH-ZFRpBvRTHhrh8DkXUQ7x&index=10
Dr. Piers Bursill-Hall  
DPMMS, University of Cambridge

Piers took the position that there is a completely passive view between the mathematics profession and the societal consequences of their work.

Key points

- The idea of social responsibility in mathematics more or less doesn’t exist in most professional contexts.
- The symposium content so far has focused on ethics for engineering. Examples from Charles Fleddermann show how rich and sophisticated ethical training for engineers can be.
- Mathematics is a closed profession and is not accessible to many. Piers believes that there are almost no courses available to teach ethics in mathematics anywhere in the world. Professional mathematicians have no training in ethics or social responsibility.
- Other scientists like physicists, chemists and life scientists have much more and more natural exposure to ethics than mathematicians. Consider the original atomic bomb showing the effects of physics on society.
- There is a perception in the profession that because mathematics is absolute in truth and has no doubt, it is free from value judgments and ethics so it is not open to ethical quandaries. This is definitely not true, Piers said.
- At a university in Switzerland the science faculty were told they had to inculcate ethics into their curriculum. The university suggested that every course and published paper feature should reference every ethical issue that this material raises. The mathematics representative said that maths should be exempt from this because no ethical issues applied to mathematics. Ironically many of the maths graduates went to work for a large tobacco company located in the same town.
- When Piers and a colleague tried to introduce an ethics component into teaching maths at Cambridge, their ideas were met largely with indifference and some very strong resistance. It was deemed irrelevant to mathematics.
- Some believed that it would get very political, because it was thought that social responsibility was only the domain of the political Left. Piers and his colleague argued that you can have ethical arguments and quandaries from all political wings.
- The problem is that many mathematicians are “Platonists” in that they believe that the subject is transcendental, ultra-mundane, not material or physical or related to the real world.
- But it is not true. A mathematician could theoretically uncover a factorisation algorithm that renders all existing cryptography redundant. Publishing this work could make the security of many activities including banking and finance invalid impossible.

Watch Piers’ full presentation here:
https://www.youtube.com/watch?v=EprXNYAjUKI&list=PL-fOTakP4gH7F8pBvRr1Htthh8BkKUXQ72f&index=14
Panel debates

Panel debate – The Need and the Challenges
The morning panel featured:
Sir Kenneth Olisa, OBE, Chairman, Restoration Partners
Professor Fiona Charnley, University of Exeter Business School
Amicky Carol Akiwumi, MBE, CEO, Money4YOU
Professor Bobby Banerjee, City, University of London
Professor Colin Turner, Ulster University and President of EPC
Professor Zoe Radnor, VP (Strategy & Planning; EDI), City, University of London
Mark Wakeman, IBM, CSR Lead

Mark Wakefield from IBM started the debate by saying “I have long argued there is a dichotomy between people’s behaviours and values and behaviours that the body corporate espouses. People often leave their personal values and ethics at the door when they enter the workplace.”

Prof Simon Rogerson said CSR is symptomatic of compliance culture. Socially responsible STEM professionals must be aware that superficial compliance is valueless and dangerous.

Sir Ken Olisa said the disagreements over wearing PPE to contain covid showed that it’s the public’s duty, not third parties, who must take responsibility. The Met Police say they are “of the public” and the public are “of the police”. We seem to have lost that sense of big, global society in the class and caste system. We have outsourced too many decisions to either experts or leaders that people don’t participate.

Zoe Radnor said the big challenge with diversity and inclusion is that individuals don’t bring their values to the workplace so we need to create a workplace that is open to this. There is a programme called Public Value promoted by Mark Moore, a Harvard scholar that’s around bringing personal and professional values together and deliver that for public good. We need channels for people to bring their views and ideas to the public forum.

Bobby Banerjee said it is disingenuous to say that low interest rates are contingent on banks committing major fraud, referring to a comment from Mark Wakefield. Bobby said the real issue is not about CSR but about governance. Corporate governance, which is concerned with avoiding blame, is too narrow, but governance of the corporation for society, which means some power in people to direct what corporations can and cannot do. His argument is that in the current, flawed economic system we cannot achieve sustainability where a dead tree has more value than a living tree.

Amalia Petrova asked “could you elaborate on the role of civic, not civil, engineers, a term used by the Digital Minister of Taiwan talking about the contribution of civic engineers in the fight against covid-19.”

Colin Turner of Ulster University said every type of engineer should be a civic engineer. The point of engineering is the application of science for the betterment of society. The problem is that society does not see engineering in the same way fish don’t see water. The EPC surveyed our UK engineering academic departments, and showed that nearly every single one was involved in the covid response effort, making and improving PPE, modelling and analysis or making equipment. Engineering should be civic engineering, period.

Watch the whole panel debate including input from Fiona Charnley and Amicky Carol Akiwumi at this link: https://www.youtube.com/watch?v=RE-h-xT7GjWw&list=PL-fOTakP4gHZ7RHpBvRThh88DkXUQ72fJ&index=8
Panel debate – Curriculum Development

The second panel featured:

Emma Crichton, Engineers Without Borders UK
Simon Fanshawe, OBE, Founder, Diversity by Design
Adam Thilthorpe, Dir. of Professionalism, BCS, The Chartered Institute for IT
Dr Rhys Morgan, Dir. of Engineering and Education, Royal Academy of Engineering
Professor Charles Fleddermann, University of New Mexico, USA
Maria Alexiou, ESG Senior Advisor, TITAN Cement Group, Greece
Dr. Anton Cox, Associate Dean (UG Education), City, University of London
Julia George, WCIT.

Anton teaches maths and is the Undergraduate Dean at City covering all STEM subjects. He said it’s very important with maths to have empathy, and doubt – often doubt is the scepticism of others rather than doubt about your own answers. He said these are needed to prepare for mathematicians to work in society to understand the limitations and dangers of applying what they do in a commercial context.

Julia is leading the ESG debate at the WCIT in the Financial Services and Technology Panel. The WCIY operates according to four pillars, Education, Industry, Fellowship and Charity. WCIT is number 100 in the liveries movement and is one of the modern liveries companies.

Patricia Xavier asked Emma Crichton: are engineers equipped to work towards this structural change within the confines of our training, for example how empathy intersects with design?

Emma said we must ask what type of change we’re looking for. How do you gain the power to be listened to? STEM professionals should access wider skill sets to change, such as language skills, sales and marketing skills, influencers, and people to monitor or “police” doubt and ethics.

Adam Thilthorpe said we need different solutions for a digital world, because it is fundamentally different to what has gone before. The BCS runs programmes like Computers at Schools, but he said the BCS failed early on when it put solutions in boxes and taught them traditionally, because we removed context. Adam said, “In primary school we try to get kids into computer science by saying that solving problems is fun rather than asking “do you want to be in IT?” or you immediately hard-bake a diversity issue right there.”

Simon Fanshawe from Diversity by Design said organisations often think what they need to do in order to diversify or change is to be clever enough. There’s a problem to solve, with engineering, we need to be clever, and we’ll solve it. This is translated as value and the technical skills are placed at a far higher level. The recent argument at Google pitted technologists against those who criticized the outcome of the search engine; one claimed it was a technology failure, the others that it’s a moral, social and ethical duty to get this right. You need people that do both. Qualifications are valued by employers as being a safe measure but they can be one of the worst predictors for success.

Julia asked how do we actually teach the softer, non-technical training, in a curriculum? How can we create emotional intelligence as children are growing up. Leadership involves looking beyond your client or customer to all the stakeholders, your suppliers, employees, their families and beyond.

Maria Alexiou said for the past 15 years her company has been good at training employees in new skills and leadership, particularly in stakeholder management and stakeholder engagement. It is a strategic approach to assess the stakeholders you must engage with.

Natalie Wint said Rhys Morgan that softer, business skills are included in engineering courses but they are not valued at the time. Course organisers need to show why its valuable.

Rhys said it is easier to learn thermodynamics and fluid mechanics, than to identify a softer skill like systems analysis that was picked up during a course. But the main point is the predominant methods of teaching in the UK is classroom and lecture based and the students are largely passive. Historically there has been little career progression for academics in the teaching part of their role, they tend to focus on their research rather than expand their teaching methods.

Watch the whole afternoon panel debate at this link: https://www.youtube.com/watch?v=0B0wDHxw0g&list=PLfOTakP4ghZFRp8vrTHthr8DKXUQ72f&index=16
Summary

Calls to action

A note from our supporter, Engineers Without Borders UK:

This national event brought together leaders, academics and professionals with a shared value that social responsibility should be a key priority for STEM professionals.

There are millions of people working in STEM in the UK and around the world. If we could find a way of harnessing and building that capability more effectively to address social injustice, just think of the positive impact we could create.

A strong community and collective action could make that a reality. We would welcome anyone involved or interested in this topic, to join our community or get in touch (www.ewb-uk.org/community@ewb-uk.org)

Finally, we hope this event or report inspires you to take a next step:

• Ask yourself what are you going to do?
• Here are some ideas:
  • Take something from this report and investigate it further. Think about how you could share your learning effectively with at least three others.
  • 10 minute conversations can be really powerful. Think about those you can influence. Take something from this report, and open up a discussion with someone who didn't attend. Share perspectives.
  • Why not take the opportunity to listen or hear a perspective on this that you don't usually engage with. Who this is, is up to you! Perhaps it’s a teenager, student, or someone working outside the UK or the STEM profession.
  • Write down three ways you are going to do to advance this critical agenda of creating Socially Responsible STEM professionals.
  • Then deliver on your commitment.