The six things I wish I could have told my younger self

Andrew Popadynec, Coventry University

The first thing – Mechanical Engineering

When I was young I had no real idea what I wanted as a career. I had typical naive dreams about being a footballer or an astronaut. However when I was about 9 years old I visited Alton Towers with my family. I was spellbound by the size and the speed of the rollercoasters and how they twisted and turned. This experience resulted in the career ambition to design and build rollercoasters. If I could speak to this younger self then I would have told him to modify his goal to becoming a mechanical engineer and to explain to him the role of the profession and the path to achieve membership.

Engineering is essentially about design and manufacture. Engineers need to be able to solve technical problems in many different roles. This includes designing some product that meets a functional specification. There is the interpretation of test data to understand why a prototype lacks the necessary refinement or integrity in order to come up with solution options. Mass production requires considerable organisation and planning in order to make products cheaply and with the necessary quality so that all the production is virtually identical and free of defects. Engineering involves the application of science, especially physics. There are several important character traits needed to be a good engineer, for example enjoying problem solving, thinking quickly, communicating well, and an ability to work with others. Explaining all this to my younger self, I could have assured him that Engineering would have a role for him, perhaps even designing rollercoasters.

The second thing – Education

Becoming a professional engineer requires the acquisition of a considerable amount of skills and knowledge. The first step is achieving good grades at secondary school. Achieving high grades demonstrates commitment and interest in education and ability in different subjects. These grades open the door to a wider range of opportunities than is possible if you lack motivation and think education is not necessary. But what I would tell my younger self is that although good grades are important, it is the knowledge and understanding of the subjects that the grades should represent that is really what education is about.

Mathematics is a particular case in point. Maths is an essential subject to learn and an understanding builds from the fundamental concepts at primary school stage to the advanced topics taught at University. This is not clear when you are a child. I would have liked to have told myself that maths drives everything around us and is used in everyday life without realising it. Maths is more than just numbers and simple calculations. It helps with problem solving of complex issues. It encourages logical thinking when approaching situations and can promote creativity when trying to overcome obstacles.

In Engineering, maths is vital. The various areas – algebra, trigonometry, geometry, calculus, vectors, complex numbers, matrices, probability and statistics – form a

toolbox allowing the formulation and solution of engineering problems. It allows the calculation of key parameters from stresses and strains acting on a structure, to how fast a fluid is accelerating through an air duct, or the heat absorbed by car brakes in a sudden stop. Understanding maths and how to apply it in these types of situations is crucial to ensure that when you design anything, it will be fit for purpose and not fail during operation. The concept of a "mathematical model" is now something I well understand. But when I was a nine year old, maths was difficult, demanding and daunting and a better understanding of its role in my future would perhaps have motivated me to study better, not just cramming to achieve good grades.

The third thing – Experience

When applying for graduate jobs, a degree is not enough. Experience and a wide range of proven skills is now essential to being considered for an engineering post in a company. Student industrial placements provide the opportunity to gain relevant experience in an area of engineering. It also demonstrates commitment to the field of engineering and a genuine interest in a specific company and work activity. I was fortunate in my choice of university which places considerable emphasis on the value of student placements and provides extensive support to students though the application and interview processes.

Experience gained through a yearlong placement last academic year has given me substantial exposure to how an engineering company operates. I was able to work in the automotive industry, being responsible for a number of components for the time period of my employment. By doing this job I came to understand much of how the company was run, and how it used its resources effectively.

I learned a large amount of technical information but also about organisational issues which included how a project is managed, timescales and costings. I was able to apply some of the knowledge I had learned in the academic modules to the real life engineering environment. Much of what I learned was from making mistakes, then understanding how and why I had made them. Through the experience gained in taking on a responsible role it is possible to demonstrate that you can be relied on and can work as part of a team. I found that being flexible and creative were the most important skills I needed. I have now been able to use this experience and skills in my final year at university, especially in carrying out my individual project.

I would also like to tell my younger self that it is not just academic knowledge that wins a university place and engineering experience that secures a good graduate job role. Having other experiences makes you a well-rounded individual who has social skills and personality. For example it is beneficial to be able to play a musical instrument and to take part in sport because these promote friendships, fitness and are fun to do.

The fourth thing – Teamwork

The most critical skill characteristic I have recognised through education and other experiences is the importance of teamwork in Engineering. Without teamwork little would get done as people need to work in a group to share responsibility and

achieve a common goal. When working in a group it is important to be a team player and to know when to encourage other people to contribute. Being a group leader is not easy as you have to adapt to different people's abilities and interests and motivate them in different ways. Good communication is crucial in these situations and responding in a respectful way is always important.

There are times when you have to work in a group or lead a group of people who you do not get along with. This brings challenges such as group tension and low motivation. In these situations, you must be considerate and act professionally with your team. But also you must be ready to challenge when something is not right and find the right solution to overcome the problem.

Social interactions are useful for teamwork and being approachable is a good character trait. Having a friendly disposition can be useful to network with people in and out of working life. It can expand your circle of friends and can lead to new opportunities you may not have considered. I would particularly advise my younger self to surround himself with a good group of friends who are hardworking and conscientious. It is easier to achieve your goals when you have friends to share the journey.

The fifth thing – Globalisation

Globalisation is something that I would have liked to have explained to my younger self. The way products are manufactured now has changed from earlier decades. Engineering has been globalised - meaning that products are designed in one country and manufactured in another country across the world. In some cases component parts are brought together from multiple countries and assembled by the end manufacturer. This is particularly true in the automotive and aerospace industries. The globalisation of engineering has seen countries that not long ago lagged behind in engineering production, becoming industrial powerhouses in terms of quality manufactured products at low cost. In the current worldwide engineering job market, an engineer could potentially get a job anywhere in the world doing a variety of different jobs.

Knowing this, it is useful to be able to speak more than one language. Although English is regarded as a major international language, having the ability to communicate in another language is ideal because it can help you in a new job role abroad, by being able to interact with work colleagues more effectively. It will also help you settle into your new surroundings and will make everyday activities such as shopping and socialising easier. Appreciating the different cultures around the world and how people live is important, and being able to adapt to how people live is just as significant when working abroad.

The horizons of my younger self were limited to Wolverhampton and the Birmingham area. I would have liked to have told my younger self that in just a dozen years' time he would be working as an engineering student intern in India with a major international company.

The sixth thing – Computers

In the last few decades the way the world works has completely changed. We live in a digital age. In 2016 life is largely computer based with everything online, from shopping, booking travel, to internet banking. This trend can also be seen in the engineering sector. Everything is now run by computers, monitored by metrics and hardly any design, testing or manufacture is carried out entirely manually.

Digital control has almost completely replaced analogue control in Engineering. It is much more flexible, allowing complex algorithms to be used in anti-lock braking, traction control, flight management, and many other systems.

In the design process, little is done by hand now, except perhaps initial concept sketches. Computers use a variety of 3-D software that can design components and validate them through computer simulations to make sure they are safe for use and can be manufactured easily and cheaply. Test laboratories generally use computers to collect and analyse data. This is true of noise and vibration labs, engine test cells, and wind tunnels. Prototypes are instrumented with appropriate transducers and their signals digitised so that computer software can perform the necessary analysis.

There are mega manufacturing factories which use very large and expensive machines and robots to carry out complicated tasks to extreme precision. Due to this, there are minimal factory workers. Automated processes save money, time and error. It is extremely useful in today's technology age to have good IT skills. An engineer must be able to use basic commercial software such as Excel, Word and PowerPoint to a high level because of their application in manipulating data, and in communicating information and ideas. Most engineers also have a thorough knowledge of specialist design and analysis programs relevant to their discipline: 3-D CAD, finite element analysis, computational fluid mechanics, modal analysis, process simulation, and many others.

My nine year old self was very familiar with computer programs in the form of games with animations of cars on race tracks. It would have surprised him that automotive engineers use software to simulate the behaviour of cars cornering or swerving on road surfaces. But these programs are underpinned by physics and provide valuable information at the design stage of new vehicles.

In conclusion

These are the six things that I would like to have told my primary school self about Engineering. I know now that I have chosen the right career path. Engineering provides a career that is interesting, challenging, and exciting. The pace of change in technology continues to gather speed. The problems that the world faces, particularly regarding energy, transportation, and environment, require engineers. The opportunities are wide ranging and global. Lastly I could have reassured my younger self that a rewarding career awaited him.