Engineering Education Research Group: A Summary of Main Achievements in 2020

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Thanks to the invention of the transistor in the late 1940s, the field of electronic engineering has witnessed a rapid transformation. However, the way that the discipline has been taught is still deeply rooted in 20th century methods and textbooks. A paradigm shift in the way engineering is taught at universities is therefore necessary to ensure that bright minds are attracted to this important profession. I believe that the University of Glasgow can be world-leading in this undertaking. In fact, celebrating James Watt's vital role in kick-starting the 1st industrial revolution, my motivation is to highlight our group's efforts in attracting engineers who can nurture the 4th, distributed cyber, industrial revolution.

The Engineering Education Research Group (EERG) at the University of Glasgow was formed in 2019. During this period, the group has focused on two main areas in the area of engineering education, which are 'active learning' and 'technology enhanced learning'. A summary of the group's main publication achievements are highlighted below.

In the area of active learning, the group trialed implementing Project Based Learning (PBL) and Team Based Learning (TBL) in various electronic engineering modules. Despite the importance of teamwork, few modules in the UK integrate TBL in their engineering curricula. Therefore, TBL was introduced in a new module called "Team Design and Project Skills".

According to the literature, the implementation of TBL has enabled more students to pursue engineering degrees and has demonstrated an improvement in student exam performance (Ghannam and Ahmad 2020). In our case, 320 Students took part in the TDPS module and over 90% reported improved learning. Due to the challenges in assessing individual contributions in these teams, We asked students to maintain Electronic Laboratory Notebooks (ELNs), which were used for evaluating student performance. Further details regarding these projects can be found in our two recent publications (Ghannam and Ahmad 2020; Ghannam 2020).

Moreover, we introduced another active learning technique known as PBL in a module concerned with energy harvesting. Comparisons between traditional and PBL teaching methods were presented (Fan et al. 2020). Naturally, 80% of students favoured the PBL teaching method, indicating that it provided better opportunities for independent learning.

In the area of technology enhanced learning, our group has investigated the range of ICT tools that can be used to facilitate remote supervision of final year project (FYP) students (Ghannam, Hussain et al. 2020), as well as the methods for improving student engagement using Piazza (Ghannam, Qammer and Hussain 2019). With Piazza, we discovered that over 250 undergraduate students taking a course on Microelectronics were able to receive feedback to queries within 30 minutes.

Information visualisation is another topic within the area of technology-enhanced learning that the group is investigating. We are interested in understanding the impact that visualisation tools can have on student learning. Here, we embarked on a project that aimed to help our transnational students visualise their electronic engineering curriculum using a web-based, interactive tree map. A total of 438 students were invited to participate in the project. Over 70% of surveyed students reported positive experience with the tool (Ghannam and Ansari 2020).

Furthermore, We demonstrated our approach in developing a new web-based database, which was used for producing a high turnover of exams as well as continuous assessments. The intended users of this tool are exam setters, external examiners and administrators (Ghannam, Allan and Roy 2020).

As for curriculum development using technology, we performed a systematic review of educational programmes that train neuroeneingineers in designing wearable and implantable products (Ghannam, Curia, Brante, Khosravi et al. 2020; Ghannam, Curia, Brante, Fan et al. 2020). We discovered that only 15 institutes provided postgraduate training in areas that satisfied our search criteria. The majority of these institutes were located in Europe and North America. However, since neurological diseases are predicted to pose a heavy economic on developing countries in Asia and Africa, we stressed the importance of cross-border collaboration for building the necessary expertise and know how in these countries. As an example, we mentioned a successful EU funded project on solar energy systems design, which was developed in collaboration with European higher education institutes (Ghannam et al. 2019).

The year 2020 brought plenty of challenges in delivering engineering curricula. Being a practical discipline that often requires the use of lab equipment, we are still unaware of the consequential impact that the pandemic will bring to university applications next year. One thing's for sure, COVID19 presented university lecturers a unique opportunity to reflect on their teaching practices. In the meantime, our group aims to continue pushing the boundaries of knowledge at the intersection of active learning and technology enhanced learning to ensure that students are always excited to study engineering!

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