



Teaching and the Fourth Industrial Revolution

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When one thinks about the Industrial Revolution, an image that might come to mind is that of a big factory with black smoke coming from the chimneys, and a young *Oliver Twist* asking: “Please sir, can I have some more”.

Fast forward to the 21st century. The Industrial Revolution of the 18th and 19th centuries has long gone, and information is everywhere. Most of the world’s population is connected to at least one device at any given moment and most of us have asked: “Please, smart phone, do some more.”

Nowadays, students who enrol for study programmes at universities are no different. Generation Z, as they are known, are clip-thinkers and process data at enormous speeds. They regularly face the choice of deciding what information is relevant to their situation. They will Google until they find that “something more”, whether their lecturers give it to them or not.

As the Fourth Industrial Revolution (4IR) repaints the picture of society in its entirety, South African universities have to adapt their teaching and learning strategies. The rapid changes in our environment challenge lecturers to use new technologies to their advantage.

For instance, the use of 3D printers, also known as additive manufacturing, is becoming more widespread. This phenomenon makes the manufacture of unique items as easy as sending a file to a computer and printing it. Students can rapidly ideate, create, test and improve physical objects like never before. This process allows assessments that require actual physical products from students,

showing the entire journey from concept to delivery. The use of such assessments has not been restricted to one discipline, and despite being technically sophisticated, students can create something that is genuinely at the centre of their learning, whether they are novices or experts. This phenomenon has allowed modules to have a more hands-on approach through the visual creation of physical objects from digital files to stimulate interest, which makes the content relatable and more memorable.

The University of Pretoria understands the importance of these technologies in teaching and learning. In 2015, the Department of Library Services became the first library in South Africa to open a library MakerSpace. The MakerSpace is equipped with soldering benches, 3D printers and computers on which to design and render models. This creative space enables students to fulfil their creative potential by giving them access to specialised equipment and collaborative space in which to work.

Additive manufacturing is not limited to the classroom. For example, veterinary dentists can print patient-specific models to help students work out how to approach each procedure. This not only enhances the teaching and learning experience, but also reduces the duration of actual procedures.

In terms of the internet of things, lecturers have a myriad of technologies, such as Arduino and M5Stack, at their disposal. Arduino is an open-source electronics platform that is popular in the prototyping of digital devices. It is based on easy-to-use hardware and software. Arduino boards can read inputs and turn them into outputs.

A simple example of such a device is a weather display system that receives temperature input and displays it on a small LED screen. An M5Stack is a robust, Arduino-compatible open-source development kit with stackable modules and a user-



→ *The MakerSpace in the University's library allows students to experiment with additive manufacturing.*

friendly, integrated development environment, among other things.

Arduino kits and M5Stacks are used to create customised solutions, from making products smarter to creating devices that track relevant data.

These technologies are also used to make everyday items much more interactive and connected to meet people's need for instant feedback. For example, one can build a chess-playing robot with feedback and

data points within a few hours. The learning outcomes that these technologies can help achieve are only limited to what students can imagine.

Ultimately, students will never stop asking for more; they will never be satisfied with enough. As educators, we need to take advantage of this fact and allow these students to grow and help us shape the 4IR. We need to answer students' most pertinent question: "Please, can I learn some more". 🧠