8 What's next?

This Toolkit has focused on the most common types of learning and teaching space in universities (with the exception of library and learning resource centres which have long been at the forefront of innovative learning space development and are already well documented). There are however many other areas where innovation is taking place:

The University of Liverpool has taken the bold step of developing Central Teaching Laboratories (CTL)[185] where space, equipment and technical staff are shared across physical and environmental science subjects. The sharing of equipment means that the University can supply more and better technical equipment for its students. Some items that were unaffordable for use by small groups can be viewed as a sound investment when used by large numbers. This means that some departments have access to facilities that were previously unavailable to them. Savings made on the bulk purchase of equipment also mean that the University can now loan items of equipment to students.

The key benefit is the better quality resources available to all disciplines and the curriculum change that this facilitates. More problem based learning is being introduced in some areas to reflect life as a working scientist. Students need to understand the problem they are trying to solve, decide what laboratory observations would provide answers and design and evaluate their own experiments. This is very different to traditional laboratory teaching where the teacher has already made most of these decisions and thus provided the *recipe* to be followed.

Photo 17: The Central Teaching Laboratories at the University of Liverpool promote interdisciplinary collaboration.
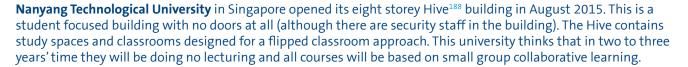
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Space utilisation is more efficient: the University has a laboratory space utilisation rate of around 48% compared to a sector average of around 20%. Maintenance and staffing costs per square metre are lower than for the previous dispersed laboratories even though the new facilities are of much better quality. First and second year physics students now have 30 to 50% more practical work than previously and there has been an increase of 35% in student numbers in physical and environmental sciences with no need for an increase in technical support staff. The CTL won the 2012 S-Lab New Laboratory Building Award[186] and the 2013 Guardian University Best Facilities Award[187].

185 www.liv.ac.uk/facilities-management/campus-development/central-teaching-labs/
186 Effectivelab.org.uk (2012) The Effective Laboratory: Safe, Successful and Sustainable - Results of the 2012 S-Lab Awards and Conference: http://www.goodcampus.org/files/files/83-117899_SLAB_Conference_Results_V10_12.pdf
187 The Guardian (2013) University facilities winner: University of Liverpool: http://www.theguardian.com/higher-education-network/2013/feb/26/university-facilities-winner-university-liverpool

Nanyang Technological University in Singapore opened its eight storey Hive[188] building in August 2015. This is a student focused building with no doors at all (although there are security staff in the building). The Hive contains study spaces and classrooms designed for a flipped classroom approach. This university thinks that in two to three years' time they will be doing no lecturing and all courses will be based on small group collaborative learning.

Nottingham Trent University Library opened a roof garden learning space in 2015. Students appreciate being able to work out of doors whenever possible even in the UK climate and outside space should be regarded as potential learning space.

Student accommodation is a topic that merits further attention. James Rutherford, Learning Spaces Development Manager, University of Birmingham, reminded us that institutions have a responsibility to residential students to be a *home from home* and to make students comfortable, yet some accommodation is less than homely. James feels that a relatively untapped area at present is the idea of creating more informal learning spaces in halls of residence, *"so they become more than just housing blocks"*.

Photo 18: Roof garden learning space at Nottingham Trent University.

Socio-constructivist pedagogies such as active, problem based and enquiry based learning are also being promoted in innovative types of space known variously as maker spaces, innovation commons, tinkering spaces and hacking spaces that are growing in currency in the US, particularly in schools, libraries and community centres[189]. They are places for self directed, peer to peer and collaborative project based learning arising from informal, unstructured activity focused on creativity, exploration, play and problem solving. They often have a technical or science focus and may house equipment such as 3D printers and Raspberry Pi microcomputers[190] but they can equally have a creative arts focus. Some university maker spaces house equipment such as engineering and woodworking tools and safety training may be a prerequisite for using the space.

The MakeSpace[191] at University College London is one example from the UK; Barrett et al (2015)[192] have summarised Maker spaces in US universities and there is a useful website on Maker spaces and 3D printing in US libraries[193].

Toni Kelly, Associate Director, Learning Environments, University of Hong Kong, views evaluation as part of a continuous learning process and her philosophy is always to want to make the next learning space better than the last one. She finds countless sources of inspiration for this: *"There are so many people doing such brilliant things - you think you've got all the bases covered then you come across somebody doing almost the same thing but by adding a bit of technology or a bit of creative design they have made it better. You might call it 'space envy': we are always searching for perfection"*. Toni is excited by a range of new developments such as innovation commons, maker spaces and tinkering spaces. Her message to readers of this Toolkit is that the good practice guidance here is only a start: *"We need to make it clear that this isn't the end and more is coming…"*.

188 http://media.ntu.edu.sg/NewsReleases/Pages/newsdetail.aspx?news=a161986e-ddb6-47de-8cf6-25264cefd934
189 https://en.wikipedia.org/wiki/Maker_culture
190 www.raspberrypi.org/
191 www.instituteofmaking.org.uk/makespace
192 See Barrett et al (2015): A Review of University Maker Spaces. American Society for Engineering Education: https://smartech.gatech.edu/bitstream/handle/1853/53813/a_review_of_university_maker_spaces.pdf
193 http://library-maker-culture.weebly.com/makerspaces-in-libraries.html