Educational innovation Through Building Adaptation

Alexi Marmot

How can school and university buildings adapt to accommodate growth and significant change in educational technologies? How can new buildings be designed that will stand the test of future change? Architect and planner Alexi Marmot, Professor of Facility and Environment Management at the Bartlett Faculty of the Built Environment, University College London, looks at innovative upgrades of old educational buildings and conversion of other facilities into contemporary schools, colleges and universities fit for now and the future. She identifies general principles and useful tools that can help educators, architects and designers working in the field.

Continuing Growth and Change in Global Education

From modest rural schoolrooms in the global south to grand architecture in colleges and universities in wealthy nations, educational buildings are multiplying and changing. Every nation today recognises the importance of education in developing its people, its society and workforce so that they can better participate in an increasingly knowledge-based global economy. Learners at every level are becoming more numerous as both the global population and participation rates in education increase. Pre-school, primary, secondary, college, university and lifelong learning are all expanding.

For architects, project managers, contractors and their clients, the design and refurbishment of educational facilities is a flourishing sector. There are at least 1.4 billion current learners across the globe – about 500 million in primary schools, 700 million in secondary schools and over 200 million in tertiary-level education.[1] In the UK alone, university floor space covers 21 million square metres (226 million square feet), while the annual capital investment in university buildings is £2.5 billion.[2]

Historically, most education took place in the presence of a sage, a learned teacher, lecturer or professor who shared knowledge through the spoken word and manuscripts. Printed books began to proliferate over scarce handwritten manuscripts from the mid-15th century with the invention of the printing press, thereby reducing the importance of face-to-face education. Once the basic skill of reading had been mastered, all the world's knowledge, it was argued, could be discovered through self-study, through reading alone. Yet today, more than five centuries later, most children still flock daily to a place called 'school', and young adults attend a place called 'college' or 'university', where their learning is still guided by teachers and stimulated by being in the company of other learners, learning with and about them.

Image 1

Digital technologies of the last few decades are potentially a huge disruptor of the way in which we learn. Online journals and books may potentially render obsolete printed journals, books and libraries – yet sales of printed books are increasing in some countries while ebook sales decline. Free TED videos presented by the most brilliant minds and articulate speakers in the world are watched by millions, while mass open online courses (MOOCs) have grown to provide learning to 35 million people between 2011 (when the name was coined) and 2015,[3] and the numbers continue to grow. Virtual learning environments are predicted to displace face-to-face educational sessions, however digital technologies for remote learners who can be 'anywhere' still need to be housed 'somewhere'. Harvard Business School, for example, has created the HBX Live, a digital classroom with walls formed of multiple large screens using sports-casting technology, so that students from any part of the globe can simultaneously share ideas with one another and the lecturer. HMX, Harvard Medical School, is now emulating this innovative form of delivery using a digital immersive space.

Place Matters

However human biology and social preferences still favour the rich, multisensory effects of face-to-face encounters that are hard to emulate virtually. Place still matters. Architects and their education clients still need to invest in places of learning for increasing numbers of people, applying a variety of pedagogies within different spaces for group teaching and learning, simulated environments, immersive classrooms, peer-to-peer and social learning places, individual learning places and external places.[4] Learning analytics that explore differences between those who achieve high and low grades often find that attendance in class and at the institution is associated with success. From this comes the idea that designers and educators are striving to create a 'sticky' campus or learning place that attracts students, where students want to, and do spend more time, enabling more interaction between teachers and learners, between learners, and with the digital assets that aid learning.

Diverse teaching modes need to be accommodated: active and passive learning; making and reflecting; 'chalk and talk'; 'sage on the stage'; 'guide by the side'; digital hubs; student centres; individual assessment and group work; personalised and group learning; and local and global transmission in real time to proximate students or remote learners. Educational places are tasked with keeping the staff and learners engaged while also acting as a focus for their local community, acknowledging that learning assets in schools, colleges and universities can be shared more widely, spreading knowledge beyond the pupils to their families and to the broader society. The halls, libraries, art rooms,

gyms and grounds of schools, colleges and universities may house events to which the public is welcomed – political discussion, voting, music and theatrical events, fairs and displays. Adaptable buildings and spaces open for extended hours across most of the year are an essential prerequisite to meet these demands.

The Adaptation Ladder

The adaptation ladder devised by Alexi Marmot Associates [AMA] provides a framework for choosing the right level of design intervention when faced with refurbishing an existing building to meet emerging needs, or designing for the future long-term adaptability of new buildings. It has parallels with Stewart Brand's 'shearing layers' concept of site, structure, skin, services, space plan and stuff.[5] Each rung of the ladder increases the complexity, time and expense of change while extending the opportunities that the change can deliver.

The lower rungs (small steps) introduce inexpensive changes that can be executed quickly, the superficial items that are the easiest to change: furniture, equipment, wall finishes and floor surfaces, new surfaces for writing and presentation, changes to portable equipment, external blinds and signage. Noticeable changes can be implemented within just a few days or weeks, as, for example, in the world's first university, the University of Bologna, established in 1088, where new desks, cabling, lighting, computers and digital projection have transformed learning possibilities while respecting its many historic buildings, even frescoes and painted ceilings. Many historic buildings in educational establishments around the world have been transformed in similar ways. Small projects with small budgets that create a big impact include improved entrances, better catering in more obvious locations, student centres and spaces for community engagement and display.[6]

Image 2

The next rung up the ladder is slightly more disruptive and expensive, entailing changes to internal walls and services. By ripping out some walls and adding others, the floor plan, layout, room sizes and connections between them can be reinvented. Equipment and the routing of power, Internet, media and lighting can be updated while ventilation and air-conditioning may need to be changed. Some buildings require the upgrading of plumbing and drainage services, especially in teaching and research laboratories, or where user numbers are multiplied. Consarc Design Group's conversion of a historic library into a graduate student centre at Queen's University Belfast (2016) is an elegant example of repurposing an existing building through internal changes.

Image 3

The next rungs realise more ambitious change by altering the external envelope of the building. New openings, windows and doors, exterior cladding and additional insulation can all be deployed to refresh a building's appearance and outlook from within, to make it more sustainable, and to make places for new educational practices. Extra wings might be inserted and floors added. By adding a new wing and staircase, extra floors and a cantilevered perimeter belt of additional space on every floor, Hawkins\Brown recently transformed the Bartlett School of Architecture at University College London (UCL) into a far larger, more collaborative and expansive environment for studios, workshops, displays, crits and public gatherings. In Malmö, a heritage port building has been refurbished in 2015 by Kim Utzon Arkitekter into offices for the World Maritime University, with a distinctive, metal-clad new wing of teaching and circulation spaces juxtaposed against the old.

Image 4
Image 5

Towards the top rung of the adaptation ladder, with a fresh perspective on the real estate, site and buildings below, new possibilities emerge, premised on the understanding that, for an educational institution to flourish in future it may not be well served by refurbishment. A whole building may need to be sacrificed to allow a new phoenix to rise from the ashes, usually one that is larger, grander and essential to meet expansion. The Dr Chau Chak Wing of the University of Technology Sydney (UTS) Business School, designed by Frank Gehry in 2015 and reminiscent of his 2004 Ray and Maria Stata Center for the Massachusetts Institute of Technology (MIT), is an iconic example of the design freedoms that a new building makes possible. It may be memorable, attract excellent academic staff and students, and become the image of the institution. However, the bespoke quirkiness may inhibit future change. By contrast, Manchester Metropolitan University has invested in a large new building of three linear wings designed by Feilden Clegg Bradley Studios (2012), with 12-metre (4.5-foot) clear floor spans allowing many different uses to be accommodated: from large lecture theatres to small offices for the business school, student services and the university hub.

Image 6
Image 7

Long Life, Loose Fit, Low Energy

When in 1972 Royal Institute of British Architects (RIBA) President Sir Alex Gordon articulated his inspired formulation of 'long life, loose fit', he included a third concept: 'low energy'.[7] Extending the life of a building through adaptations avoids the premature loss of embodied energy, of invested capital, while preserving a sense of continuity and of history.

Victorian School Board edifices in UK cities are an excellent example of educational buildings that have proved robust and adaptable for over a century of educational change. Their high ceilings and windows provide low-energy lighting and ventilation, and opportunities to insert mezzanines for additional needs.[8] Their structures are sufficiently attractive and sound, yet malleable enough to allow ready conversion into workshops, offices or apartments when educational needs have diminished within the area. Many postwar schools have neither endured so well nor provided as comfortable, healthy and energy-efficient internal environments due to their less robust materials and construction, and meaner floor spaces and heights. More recent school models combine sustainability and construction quality with student-centred design and are likely to last longer.[9]

Visionary Architects and Clients

Those with the power and funds to determine capital investment are attracted, not infrequently, by the phenomenon termed the 'edifice complex'.[10] Whether the client is a headteacher or bursar, a vice-chancellor, chair of governors or estates director, the birth of a new piece of architecture is usually more alluring than stretching the life of existing buildings with their patina of the past.

Vision from both architects and from their clients is essential in exploiting the adaptability inherent in older buildings, and in creating new buildings that are sufficiently robust to meet future demands. How can architects design future-proof buildings? A suggested checklist includes incorporating demands for future adaptability into design briefs,[11] then testing early-stage designs through a series of scenarios. Such scenarios might include imagining what could be done if, for example, the number of students were to double; if permitted CO_2 emissions were halved; if the building had to be converted from natural ventilation to air-conditioning or vice versa; and if uses were to change from classrooms to laboratories, staff offices or student residences.

Scenario testing in this way can help to pinpoint design changes that will encourage long-term adaptability; for example, strengthening the foundations and structure to allow for extra future floors, providing oversized and accessible vertical and horizontal service routes; or creating 'soft spots' in floors for additional ducts, services and staircases to be inserted later on. However, it is usually enduring architectural qualities that ensure the longevity of a building for which adaptations will be worthwhile: thoughtful placement on the site; respect for the surrounding landscape and urban fabric; colours and textures; materials and details that weather well; and creating comfortable and sustainable internal conditions that do not cost the earth.

Notes

1. Global estimate of learners compiled by the author from UNESCO and World Bank gross enrolment ratios and population by age group, data for 2013. United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, DVD Edition; http://data.worldbank.org/indicator/SE.PRM.ENRR; http://data.worldbank.org/indicator/SE.SEC.ENRR; http://data.worldbank.org/indicator/SE.TER.ENRR

2. Association of University Directors of Estates (AUDE), HE Estates Statistics Report 2015: www.aude.ac.uk/resources/news/view?g=7f6f8a92-3d5d-4afc-aca3-e860b68ee928.

3. Online Course Report (OCR), 'State of the MOOC 2016: A Year of Massive Landscape Change For Massive Open Online Courses': www.onlinecoursereport.com/state-of-the-mooc-2016-a-year-of-massive-landscape-change-for-massive-open-online-courses/.

4. AMA Alexi Marmot Associates and HAA, *Spaces for Learning,* Scottish Funding Council (Edinburgh), 2006.

5. Stewart Brand, *How Buildings Learn: What Happens After They're Built,* Viking Press (New York), 1994.

6. RIBA and HEDQF, *Small Budget, Big Impact,* RIBA (London), 2011.

7. Craig Langston, 'Measuring Good Architecture: Long Life, Loose Fit, Low Energy', *European Journal of Sustainable Development,* 3 (4), 2014, pp 163–74.

8. Phillip Steadman, 'English Elementary Schools: From the Central Hall to the Pavilion Plan', *Building Types and Built Forms*, Matador (Leicester), 2014, pp 123-160.

9. Prue Chiles (ed), *Building Schools: Key Issues for Contemporary Design,* Birkhäuser *(*Basel), 2015.

10. Deyan Sudjic, *The Edifice Complex: The Architecture of Power*, Penguin (London), 2005.

11. Julian Robinson, Joanna Eley, Kenn Fisher, Mike Entwisle, 'Value and Performance', in Ian Taylor (ed), *Future Campus: Design Quality in University Buildings,* RIBA (London), 2016, pp 113-133.

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Captions

1.
Pietro Canonici Sepulchre, Museo Civico Medievale, Bologna, Italy, 16th century.
Learning in the presence of a master before the spread of printed books and reading. Canonici, a distinguished lecturer in civil law, died in 1502. The sepulchre was originally housed in the Chiesa di San Martino.

2.
Alexi Marmot Associates (AMA), Adaptation ladder, 2017
A framework for selecting the level of design intervention. Each rung raises the complexity, time and expense of change while increasing the possible benefits

3.
Consarc Design Group, Lynn Building, Queen's University Belfast, Northern Ireland, 2016
The Venetian Gothic revival library building of 1868, has been sensitively remodelled into a graduate student centre housing seminar and lecture rooms, group and individual study spaces and social gathering spaces.

4.
Hawkins\Brown, Bartlett School of Architecture, University College London (UCL), London, UK, completed 2016
The floor area has been doubled and the original building transformed by a new wing and staircase, extra floors and cantilevered perimeter space encircling every floor.

5a and 5b
Kim Utzon Arkitekter, World Maritime University, Malmö, Sweden, completed 2015
The dramatic new block of teaching and circulation spaces is juxtaposed against the office wing conversion within a former port building.

6.
Gehry Partners, Dr Chau Chak Wing, University of Technology Sydney (UTS) Business School, Sydney, Australia, 2015
Inventive forms and bespoke quirkiness internally and externally are thought to attract new students, however they may mitigate against future change within this iconic building.

7a, b & c

Feilden Clegg Bradley Studios, Business School, Manchester Metropolitan University, Manchester, UK, 2012
The building and its services are designed for ready accommodation of a variety of uses and for anticipated future change. Services are roputed through the floor void and ceiling soffits, enabling spaces to be reconfigured without adding or moving mechanical services.

Floor plan, 4th floor. Three adaptable 12-metre (4.5-foot) wide linear wings house teaching spaces, a social hub, offices and other facilities.

Cross-section showing the horizontal progression from the student hub and coffee shop on the left to the Business School on the right, and vertical progression from large lecture theatres on lower floors to seminar rooms at mid level and offices on the highest floors.