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Integrating a Climate Change Adaptation Agenda into Architectural Education

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Abstract

This paper explores how architectural educators can integrate climate change adaptation considerations into design studio pedagogy. A case study of a project that asked students to design an environmental education centre for a site that is particularly vulnerable to the impact of climate change is presented. This project required the students to make future speculations about the evolution of their design proposal and the associated climatic and environmental context with a high emissions greenhouse gas (GHG) scenario up to the year 2084. This pedagogical approach was reflected upon, by the learning facilitators, throughout its duration. These reflections were triangulated against written and verbal feedback from the architecture students and, also, against peer review of the teaching approach by other architectural educators. Based on these multiple methods of reflection, pedagogical tactics for integrating climate change adaptation into the design studio are presented. These tactics and the lessons learned can be adopted by other architectural educators with similar educational goals.

Introduction

Climate change is one of the most critical and pressing issues of our time. The most recent Intergovernmental Panel on Climate Change (IPCC) report has warned there are only 11 years left to keep global warming to a maximum of 1.5°C above pre-industrial levels and if this temperature rise is exceeded, by even half a degree, the risk of floods, drought, extreme heat and poverty for hundreds of millions of people will be much greater. It is estimated that buildings use 30-40% of global energy, and therefore, the architecture profession has a significant role to play in helping to mitigate the effects of climate change. Correspondingly, the technologies, methods, techniques and tools for creating and retrofitting buildings to be low/zero energy consumers are now well established. Given that the expected lifespan of a building is 60 years and that we are currently on course to have a 2.7-3.7°C temperature increase by 2030, built environment professionals also have a role to play with regards to climate change adaptation. They will need to consider that in the future people’s health and wellbeing will be impacted by higher temperatures, that buildings and communities will be at risk from flooding,

1 IPCC. Global warming of 1.5°C - Summary for Policymakers. (Intergovernmental Panel on Climate Change, 2018).
that there will be increased wind and driving rain and that there will be more frequent extreme weather events. As a result, architectural design proposals will have to respond and adapt to a changing context and significant work has already been dedicated to this issue in the professional realm\textsuperscript{7,8}. Architectural educators also have a role to play in addressing these climate change challenges. Although there is a body of work that explores how to incorporate sustainable design and climate change into architectural education, most of it focuses on how we can contribute to climate change mitigation efforts\textsuperscript{9,10,11,12}. There is a lack of case studies that explore how to integrate climate change adaptation into architectural pedagogy. This paper seeks to address this deficiency and presents a reflection on an undergraduate design studio project that sought to equip architecture students with suitable strategic thinking skills to address climate change adaptation challenges.

**The Design Studio Project Described**

The case study project challenged the students to design an environmental education centre in Derry-Londonderry, Northern Ireland, to think creatively about the future of this context in 2084 and to devise strategies for the built environment to adapt to a high GHG emissions scenario. The project was in the city centre, just outside the 16\textsuperscript{th} century city walls on a prominent piece of reclaimed land adjacent to the local council chambers, the regional transport hub and the main gate to the walled city. It is important to note that because of the unique geographical heritage of Derry-Londonderry, this site is particularly vulnerable to the impact of climate change. The walled city was established on the site of a 6\textsuperscript{th} century monastic settlement on the Island of Derry between two branches of the River Foyle (see Figure 1). Over time the western channel of the Foyle silted up and left a marshy valley between the city on the hill and the neighbouring hills to the west of the city. Today, this previously marshy area is still known as ‘the bogside’\textsuperscript{13}. Floodmaps Northern Ireland indicate that in the future this historical watercourse will be partially re-established, and the city’s riverfront area, outside the city walls, will be


\textsuperscript{8} McGregor, Alisdair, Cole Roberts and Fiona Cousins, Two Degrees: The built environment and our changing climate (Abingdon-on-Thames: Routledge, 2013).

\textsuperscript{9} Fleming, Rob, Design Education for the Sustainable Future (Abingdon-on-Thames: Routledge, 2013).


\textsuperscript{11} Stupar, Aleksandra, Vladimir Mihajlov and Ivan Simic, ’Towards the Conceptual Changes in Architectural Education: Adjusting to Climate Change’, Sustainability, 9 (2017), 1355.

\textsuperscript{12} Bozkurt, Eray, Exploration of Climate Change in Architectural Design Studio, SHS Web of Conferences, 48 vols (EDP Sciences, 2018).

\textsuperscript{13} Lacy, Brian, Siege City: The Story of Derry and Londonderry (Belfast, Northern Ireland: The Blackstaff Press Limited, 1990).
subjected to flooding\textsuperscript{14}. Therefore, in a high GHG emissions scenario it is predicted that the project site will be submerged, and the river will once again lap the city walls, just as it did in before the riverfront’s land area was reclaimed.

\textbf{Figure 1} – Left: the ‘island’ of Derry showing contours at 20ft intervals with project site in purple, redrawn by author and adapted from Lacy\textsuperscript{15}, middle: the aerial view of contemporary Derry-Londonderry with site in purple adapted from Google Maps\textsuperscript{16}, right: the outline of climate change floodplain from sea level rise in green adapted from Flood Maps Northern Ireland\textsuperscript{17}.

The student cohort consisted of a mixture of stage 2 and stage 3 undergraduate students. The project ran for a total duration of 12 weeks. In the first three weeks, the students developed an understanding of the past and present physical, social and economic context by way of desktop research and direct observation of the site. This background research then informed the creation of a broader narrative for the site, outlining how a high GHG emissions scenario would impact it up to the year 2084. The Met Office\textsuperscript{18} has estimated that in 2084 in Derry-Londonderry, a high emissions scenario would yield an approximate 90cm sea level rise, a 5-6°C mean temperature rise and a change in precipitation, with more inter-regional and inter-seasonal variability. Referencing online flood mapping tools\textsuperscript{19}, the

\textsuperscript{14} Department for Infrastructure Northern Ireland, \textit{Flood Maps NI} \texttt{<http://dfi-ni.maps.arcgis.com/apps/webappviewer/index.html?id=f6c0a1b07840269a50a2f596b3daf6>} [Accessed 1 November 2018].


\textsuperscript{16} Google, \textit{Google Maps: Londonderry} \texttt{<https://www.google.com/maps/place/Londonderry/@54.9975889,7.3239003,1235m/data=!3m1!1e3!4m5!3m4!1s0x485fdde434d09363:0xbd21fa2ac75f32f18m213d54.9966124!4d-7.3085748>} [Accessed 16 May 2019].

\textsuperscript{17} Department for Infrastructure Northern Ireland, \textit{Flood Maps NI} \texttt{<http://dfi-ni.maps.arcgis.com/apps/webappviewer/index.html?id=f6c0a1b07840269a50a2f596b3daf6>} [Accessed 1 November 2018].


\textsuperscript{19} Climate Central, \textit{Surging Seas: Seeing Choices} \texttt{https://seeing.climatecentral.org} [Accessed 1 November 2019].
students communicated their individual future narratives using sectional drawings, collages and prose. These narratives were then used to catalyse their design process.

In the next nine weeks, the students translated their research into design proposals and climate change adaptation strategies using drawing, diagramming and model making. The brief for the environmental education centre was intentionally open-ended, merely stipulating that it should act as a hub where the community can gather to learn about the natural world, ecology, climate change and sustainable living. Therefore, the students were encouraged to interpret a specific program for the building based on how they thought people would best learn about the environment. The challenge was to design a space that would best support a convivial learning experience. Over the course of the project the students also received a series of lectures from a range of expert guest speakers. The topics included climate change and the apocalypse, downscaling of climate change data for Northern Ireland, visualisation of climate change scenarios and writing of ecotopian futures.

The Project Outcomes Described

For illustrative purposes, descriptions of two of the student projects now follow.

Project 1

Based on her initial research, this student, Kayleigh Colgan, painted a bleak image of Derry-Londonderry in 2084 with a high emissions GHG scenario. She described the scene as follows:

‘The city has been subjected to a series of erratic storms. The local municipal authority had insufficient funds to invest in flood protection schemes. The increased carbonisation and acidity of the world’s water supply fed into the River Foyle, expediting the degradation of the concrete structures in its path, structures such as the Peace Bridge and the river’s retaining wall. With a storm surge of 3 meters, the river burst its banks and flooded the lower parts of the city. The first and some of the second floors of the buildings close to the riverfront were also flooded. In response, the people of the city created an improvised ‘raised street’ system. Although sky trams now operate around this area, they are infrequent due to the expense of precious fuels. With the lack of foresight and the ill-preparedness of the city officials, the city has regressed massively and there is a general fear for safety with the worsening of global warming.’
The student used this future scenario as a counterpoint from which to begin her design process. She wanted her intervention to help catalyse a transition towards a more ecologically sound future and to serve as a warning for what might happen if current GHG emission levels are not curbed. Utilising sustainable and low energy design principles, she proposed a botanic garden, consisting of a glass house and a walled garden. The walled garden displayed native plants, while the glasshouse presented a range of tropical plants and demonstrated what could be grown on this site if there were a significant temperature increase. Thus, this glasshouse served as a predicting device by way of representing potential future climatic conditions in a high GHG emissions scenario.

Through the process of designing her intervention this student revised her vision for the future for Derry-Londonderry in 2084. In this revised scenario, and at a local level, the municipal authority has adopted a city greening program, which incorporates the widespread planting of trees across the city. At a global level, the high GHG emissions scenario was averted, as the result of an intensive sequestration and mitigation program. Under these conditions, a low GHG emissions scenario ensued resulting in a 2°C temperature rise and a 30cm sea level rise. The River Foyle does not burst its banks and city prospers in the wake of a new green economy.
In 2084 and with a high emissions GHG scenario, Daniel McCorry (stage 3 architecture student), imagined that the city of Derry-Londonderry is no longer spatially divided along sectarian lines. Instead, economic disparities have shaped dwelling patterns. Safe from the rising tide, the wealthier citizens now inhabit the higher ground in the city and refer to it as Upper Derry. The poorer citizens occupy the low-lying areas, in a provisional settlement, outside of the city’s walls. He paints as image of the scene as follows:

‘The humid coastal air and mosquitos awaken you. You gaze out your window, beyond the city walls and see the brackish waters of the swollen River Foyle flow sleepily through Lower Derry. A bad parody of Venice. You see the inhabitants, who call this seemingly permanent make shift settlement home, as they continue with their difficult existence, walking along the rickety wooden pavements towards work or school. Children play in the distance, fishing for spricks in-between boats as their fathers go out with nets to earn a living. You’re amazed by the resilience of them. Their lives are hard, but decent enough to allow sustainable contempt, maybe even happiness. You look on from your affluent boarded high ground. You and the other wealthy folk from days gone by do not have the same ‘carry on as usual’ ideas. You folk within the walls are a bitter bunch. Having lost your upper-class title from the old society and having been forced to look after yourselves, you do not have much else to do other than to tend your vegetables and cattle and look at the slowly crumbling remains of your walled refuge.”

Figure 5 - The view of economically divided Derry-Londonderry in 2084, by Daniel McCorry, BSc stage 3 architecture student, QUB

In response to this future scenario, this student designs a salmon hatchery for the site and an adjoining pier that extends into the water. The produce of this salmon hatchery will then be used to restock the River Foyle. Therefore, in 2084, the citizens of his imagined Lower Derry will be able to sustain themselves through fishing. Simultaneously the elevated pier will provide a safe place of refuge on which to build a new settlement as the rising seas submerge the surrounding city.
Reflection

This design studio project and the pedagogical approach was reflected upon throughout its duration. Personal reflections were triangulated against written and verbal feedback from the students, and also, against peer review of the teaching approach by four other architectural educators. Based on these multiple methods of reflection, four tactics that helped to effectively integrate climate change adaptation considerations into the design studio have been identified. They provide useful starting points for other architectural educators to create design studio briefs that also seek to tackle climate change adaptation in other locations.

Tactic 1 – Setting a provocative scene

In the case study project, the site, offered limited shelter from the elements and was situated on low-lying reclaimed land, which is at risk of flooding. Historical paintings that depicted it being submerged by the
river provided evocative starting points for the design process. This is a culturally significant location that plays an important role in the collective understanding of the city, being adjacent to noteworthy public buildings and infrastructure. Therefore, it offered numerous starting points for constructing future narratives to expand on the UKCP18 scenarios. Furthermore, the physical attributes of the site helped the students to critically engage with the climate change adaptation issues.

Tactic 2 - Contextualising climate change scenarios using multiple creative means

The students created future narratives for the site, using multiple creative means, to describe a world associated with UKCP18 forecasts. This exercise was useful in that it helped them to make sense of and to scrutinise the data. A cross section, taken through the site, was used as the basis for this activity. Translating the plan-based information from Flood Maps NI into the sectional elevations helped to further contextualise the data. This task required the students to consider the sky, the facades and the topography of the site and to visualise information that cannot be communicated through the plan view. Writing narratives gave a further opportunity for students to express their thoughts in an alternative format and helped them to expand on their vision of the future. Building in-depth future narratives using multiple means of communication helped the students make visual, formal and contextual sense of climate change scenarios.

Tactic 3 – Encouraging the use of climate change adaptation strategies as form generators

Many of the students used long term climate change adaptation strategies to generate building forms. Their response to landscape was also driven by adaptation concerns. For instance, many of the students incorporated a raised landscape, elevated their buildings and created amphibious structures in response to the flood risk posed. Allowing the climate change data to shape the form of the buildings helped to engender a deeper understanding of issue.

Tactic 4 – Engaging in programmatic design

The brief for the Environmental Education Centre was intentionally open-ended. As a result, the students integrated broader environmental concerns into their proposals. This challenged them to make further links between and contextual sense of climate change, ecological issues and environmental education.

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20 Connup, Jacob H., Londonderry, 1863, lithograph, 105 x 210cm, Derry City Council Heritage and Museum Service, Londonderry.

21 Philips, Thomas, London Derry, 1685, pen and ink wash 48 x 91cm, British Library, London.
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