An examination of the factors influencing a cohort of post-graduate architecture students in the adoption of sustainable design practices that support health and well-being

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Abstract. Presented in this paper are the results of an interactive workshop undertaken with a cohort of international architecture students, which aimed to explore their approaches to sustainable decision-making and design, including biophilic and restorative environmental design. The intention of the research was to establish current barriers to the adoption of design strategies that support occupant health and well-being. An essential constituent of sustainable design, occupant health and well-being feeds into the overarching aim of UN’s Sustainable Development Goal 3, to ensure healthy lives and promote well-being for all at all ages. A total of 68 international post-graduate architecture students took part in the study. The results of the research highlight a significant knowledge gap, with few students demonstrating an understanding of both the direct and indirect benefits of implementing holistic sustainable design strategies, and very few reporting a knowledge or well-developed understanding of biophilic or restorative environmental design. However, the research did highlight students’ propensity towards environmentally responsible behaviour. Indeed, environmental attitudes appear to be in place, but what is currently lacking in these early career practitioners are the knowledge and skills to implement holistic sustainable decision-making.

1. Research context
Sustainability has emerged over the past two decades in particular as an important goal and frame of reference for the built environment. It is ideally understood as a holistic set of criteria or set of values for guiding (sustainable) development. These include a reduction in ecological footprints and resource needs, to deepen connections to landscape and place, and to enhance liveability and quality of life, while expanding economic opportunities for the least-advantaged, among others. Effective sustainable design and development combines lessening and avoiding adverse impacts on natural systems, as well as enhancing human health, productivity, and physical and mental well-being; which can be achieved fostering beneficial connections to nature. The latter objective builds on the view that humans possess an inherent need to affiliate with natural systems in meaningful ways [1]. Proponents of what is known as biophilic design suggest that what has become a mainstream response to sustainability is no longer sufficient and that a humanistic approach to sustainable development is required, one where rather than focusing on the application of technological advancements to generate sustainable solutions, there is a focus on cultural and personal values; the health and well-being of building occupants [2]. Kellert defined the three pillars of biophilic design as ‘nature in space’, ‘natural analogues’ and ‘nature of the space’ [3]. Amongst other issues, these highlight the value of passive design features such as access to daylighting, thermal gains and natural ventilation. Accordingly, to improve occupant well-being, important design decisions must be made which balance occupant needs and health with other goals.
including environmental impacts and design aesthetics. Combined, these support a number of the UN’s Sustainable Development Goals (SDGs) including SDG3: Good health and well-being; and SDG4: Quality Education.

2. Introduction to the project
A cohort of post-graduate students (n=68) studying on an international MA in architecture that majors in the restoration and refurbishment of heritage buildings, were asked to participate in an interactive workshop. The researcher invited the students to explore factors influencing their adoption of design practices that support health and well-being in the restoration and refurbishment of existing buildings; with an emphasis on the adoption of biophilic/restorative environmental design strategies. The workshop was divided into a number of activities, working with students to: recognise and reflect on their personal experiences by completing a questionnaire, which aimed to investigate their application of sustainable design principles (including indoor environmental quality, health and well-being, biophilia and restorative environmental design) to past projects; explore how they ‘measure’ the success of their design projects through a ‘sustainability lens’ including how they apply lessons learnt to future projects; and co-create approaches to biophilic design through learning and teaching activities; and consider how they might apply this learning (new knowledge and skills) to future projects, adopting a more holistic approach to sustainable design. A majority of the students originated from Europe, including Azerbaijan, Italy, Jordan, Poland, Portugal, Republic of Kosovo and UK; students also came from Brazil, Colombia and Ecuador in the Americas; as well as from Egypt, China and India. Half of the students were in the early stages of their design careers, with the other half having up to ten years’ postgraduate design experience. Both qualitative and quantitative data analysis was used to evaluate student experience. This short paper provides a qualitative overview of the key topics explored.

3. Reflecting on student experience

3.1 Sustainable design considerations
Students reported inconsistencies in their approach to sustainable decision making, employ strategies in an ‘ad hoc’ manner. They readily consider strategies such as passive solar design, cross flow/natural ventilation and passive cooling strategies. They also advocate the use of natural materials but a majority (78%) do not regularly/have never specified FSC timber, suggesting that students do not understand or have not heard of the global forest certification system, which ensures timber is sources sustainably. In addition, they rarely specify materials with low embodied energy, recycled or repurposed content. This may reflect boundaries where the responsibility for e.g. interior fit-outs of projects lie with other professions. It may also be indicative of the participants’ experience of work on heritage building refurbishment as opposed to new build projects where they are more likely to experiment with materials.

3.2 Indoor environmental quality
The students believe architects have the greatest responsibility for ensuring design schemes promote health and well-being and 87% agreed that occupant health and well-being was an important consideration in their own design practice. Despite this they reported an inconsistency when it came to project delivery, with a majority sighting occupant health and well-being a consideration only some of the time. When asked to focus their thoughts towards design strategies that specifically promote good indoor environmental quality, only half of the students agreed that understanding how to design spaces that promote indoor environmental quality was important to them. Indeed, students were unable describe comprehensive strategies, referring to a maximum of three approaches, the most frequent of which were utilising daylighting, followed by thermal comfort, ventilation and acoustic performance. Nearly half of students don’t believe that clients actively choose to procure restoration/refurbishment that promotes health and well-being through good indoor environmental quality. Despite this a majority (59%) concur that they are a prerequisite for all public building refurbishment projects.

3.3 Biophilic and restorative environmental design
Only eight students had heard of biophilic design. Similarly, only seven students had heard of restorative environmental design. Despite this, a majority of students stated that they do consider how their projects...
connect with the natural world, indeed consider it very important to their personal design aesthetic and ethos, and in particular on buildings that are part of a site, estate or campus-wide strategy.

Following an interactive session exploring the principles of biophilic design, 25 students admitted that they had never actively adopted any biophilic design principles in their design practice.

From student feedback it was possible to build up a hierarchy of biophilic design principles that they have adopted, from those that are readily executed, to those that are less frequently considered. The most commonly adopted are ‘light and space relationships’, followed by ‘environmental features including water, plants and natural materials’. The least reported are the incorporation of ‘natural shapes and forms’ and ‘natural patterns and processes’. The frequently adopted reflect traditional/passive design and building practises, whilst the rarely applied can be aligned with the infrequent and less well-documented benefits of biomorphism and biomimicry in design.

This cohort of students don’t believe biophilic design has been successfully embedded in the way buildings are currently designed and fitted-out, and this is reflected in their reported behaviours. Indeed, they believe major challenges include a lack of awareness of (and the benefits of) biophilic design. This includes a suggested lack of interest from clients. They expressed a shared belief that biophilic design is too expensive to execute, despite reported behaviours that they already incorporate elements of biophilic design in their current design practice.

3.4 Measures of success through ratings tools and post occupancy appraisals

Students consider informal feedback to be the principal way in which they elicit information post occupancy, including client satisfaction. Less than half have conducted formal post occupancy appraisals, this coincides with the numbers who ‘measured’ their projects using sustainability ratings tools. Indeed, there appears to be an irregularity with which post occupancy appraisals are conducted suggesting that they are driven not through a desire to reflect on the successes of a project, rather to meet ratings tool requirements. Reframing the narrative to promote post occupancy appraisals as an invaluable feedback mechanism on occupant health and well-being may go some way to redress this gap in designers’ knowledge and practice; encouraging wider engagement in both actual (indoor environmental quality) and reported perceived (verbal experiential) post occupancy measures.

3.5 Looking to the future

Following the interactive workshop, which explored biophilic design, a majority of students felt they would either consider or indeed actively promote biophilic and restorative environmental design principles in the future. However, the greatest apparent barrier, as referenced above, was the perceived additional financial cost. Consequently, there needs to be wider dissemination of the realised (and perceived) benefits, including the cost not to design for health and well-being, if take up is to increase going forward. This is the same misconception that has impacted the sustainable design and green building movement for the last 20 years and points to the need to improve on and more widely promote life cycle costing and its reporting, differentiating between initial (capital) and life cycle costs [4].

Achieving the benefits of biophilic and restorative environmental design has the potential to improve quality of life and provide direct and indirect financial benefits e.g. reduced health care costs, reduced costs of crime and violence, improve productivity and workplace performance, and consequently reduce the cost of sick-leave [5]. There needs to be more done to publicise these benefits. This includes wider reporting of end user experiences, including post occupancy feedback.

Using biophilic and restorative environmental design as a means to foster environmental stewardship received considerable support from the students. A lively debate on using ocean plastics overtly in building fit-out to highlight the plight of marine life demonstrated that the students were already thinking of ways to engage in environmental stewardship through their own practice.

4. Conclusions and recommendations

There are many examples of design projects that integrate design strategies to reduce environmental impacts on the world as well as building occupants, but wider interconnectivity or interdependence is rarely explored. While many of the leading examples of sustainable design incorporate aspects of biophilic design, many do not. This is something that should be remedied as the sustainable design and
green building movement continues to evolve. Biophilic design should be incorporated for two primary reasons: it is becoming increasingly clear that biophilic design elements have real, measurable benefits relative to such human performance metrics as productivity, emotional well-being, stress reduction, learning and healing; and from an environmental standpoint, biophilic design can foster an appreciation of nature, which in turn, should lead to behaviours that support climate change amelioration, as well as efforts to eliminate pollution and other environmental concerns, building environmental, social and community resilience.

The study summarised above highlights a significant knowledge gap, with very few students demonstrating an understanding of both the direct and indirect benefits of implementing holistic sustainable design strategies, and very few reporting an understanding of biophilic or restorative environmental design, which promotes design for occupant health and well-being.

However, the results of this study do demonstrate that the students exhibit positive environmental connections, with evidence of environmentally responsible behaviours amongst the students, including a willingness to engage in environmental stewardship. This implies that this generation of architects have the propensity to apply ‘environmental connection’ to their designs, transitioning towards environmentally responsible behaviour. In this instance it is not behaviours that must be challenged but there does need to be a concerted effort to ensure universities employ holistic learning and teaching around sustainable design and in doing so align environmental behaviours with the delivery of sustainable decision-making processes in formal education and training.

Based on the results of this current study, the assumption that holistic sustainable design is too ‘costly’, must be challenged. There needs to be a greater emphasis on whole and through life costing in the university curriculum. In addition, more needs to be done to promote post occupancy appraisals as a means of analysing indoor environmental quality, reporting the outcomes of holistic sustainable decision-making in practice. Ultimately more needs to be done to address the knowledge gap. A larger international study of design practitioners’ propensity to apply biophilic and restorative environmental design principles is being progressed, taking into account both regional issues and global contexts. By scaling-up the study, the research aims to develop a robust understanding of wider barriers. This knowledge can subsequently be used to inform localised education and training, with a particular focus on the skills and competencies required to translate the prerequisite knowledge alongside environmentally responsible behaviours, in the successful delivery of the sustainable design and fit-out of existing buildings to support health and well-being.

5. References

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Acknowledgements
The researcher would like to thank all those who took part in the study as well as the University of Wales, Trinity Saint David’s Sustainability Institute ‘INSPIRE’, who provided funding for the research through its 2018-19 “Well-being of Future Generations” Grant Scheme.