

Student Devised Assessment- Introducing the Concept of 'Embodied Nature'

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This student devised assessment (SDA) employs a transdisciplinary and interdisciplinary approach to introduce the concept of ‘embodied’ nature to a time-poor corporate audience, by summarizing recent policy, academic literature, and private-sector reports into a short, accessible ‘learning burst.’

It is comprised of two parts. The first half includes a link to the 9-minute learning burst (medium) hosted on Microsoft Stream, the transcript (embedded with in-text citations) and the references that contributed to learning burst content. The second half includes 1,835 words of critical reflection, helping the audience to understand the context, motivations, intended audience and previous knowledge supporting the development of the piece.

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Part 1: Medium

Link

SDA- Learning Burst Link

Transcript

0:0:4.794 --> 0:0:12.674

So hello, everyone, and welcome to today's learning burst, where I will explore the concept of embodied nature, a rapidly emerging focus for the built environment sector.

0:0:14.224 --> 0:0:58.184

If you are unfamiliar with the term embodied nature, do not worry. This interactive session will equip you with the knowledge needed to understand the impact of buildings on nature across their lifecycles. Firstly, exploring what we mean by nature and why it is significant, building on what we already know about our on-site impact on nature. Secondly, expanding our view beyond the red line boundary, which encircles the construction site and surrounding area to consider the impact of upstream and downstream operations embodied within construction materials, using the steel value chain as an example, to demonstrate some of these impacts. Finally explaining why embodied nature is relevant to you as building developers and designers, suggesting some immediate actions to reduce the impact of your projects today.

0:1:0.744 --> 0:1:10.504

So what do we mean by nature? Pause this video for 20 seconds to briefly summarize any ideas, comments, words, or phrases you consider when thinking about nature.

0:1:14.574 --> 0:1:19.534

You may have pictured wild animals, lush greenery, rushing waterfalls or expansive oceans.

0:1:21.104 --> 0:1:58.584

Nature is all these things, specifically the natural world, emphasizing the diversity of living things, including people and their interactions among themselves (Diaz et al, 2015). It is

comprised of four realms, including land, ocean, freshwater, and atmosphere, which support different ecosystems or biomes, such as tropical rainforests, which provide invaluable provisioning, regulating, supporting, and cultural services, such as pollination and freshwater regulation (Scottish Government, 2019; TNFD, 2023). Biodiversity measures the variability among living organisms and their changes in abundance and distribution over time and space, which can be deemed as an indicator of ecosystem health (Diaz et al, 2015).

0:2:0.904 --> 0:3:30.574

But why is nature critical? What relevance does it have to the built environment? In the past 50 years, wildlife populations declined by 69%, water scarcity increased, and more than one-third of soils degraded due to industrial practices (IPBES, 2019; IPCC, 2019). We are in the midst of a nature crisis. This is a significant risk considering that over half of the global GDP, or \$44 trillion worth of economic value generation is moderately or highly dependent on nature. And exposed to risks when nature is degraded or lost entirely (WEF, 2020). Severely impacting humanity, for example, climate regulation is one of the key ecosystem services, we already have observed an 83% increase in climate disasters in the last few decades, costing \$2 trillion worth in acute economic losses (Oxera, 2024).

In response, 196 countries ratified the Kunming Montreal Global Biodiversity Framework, establishing a global goal for nature aiming to halt and reverse nature lost by 2030 and achieve full recovery by 2050 (Locke et al, 2021).

As a sector, the built environment is a significant contributor to nature loss, responsible for 30% of biodiversity loss, 50% of global war material extraction, 40% of waste streams and almost 40% of carbon dioxide emissions (GRESB, 2021; Global Alliance for Buildings and Construction, 2022). Subsequently, as building developers and designers, you play a significant role in addressing this crisis and contributing to the global goal.

0:3:32.994 --> 0:4:9.894

We impact nature on site and within the surrounding area directly and indirectly during construction, operation, use and demolition. The most significant impacts occur during site clearance and construction leading to habitat loss, soil degradation and pollution. To address this, net gain approaches to site-based biodiversity are gaining popularity with planning regulators. For example, the UK has introduced a mandatory 10% biodiversity net gain on

site from a pre-construction baseline on all new developments. For example, installing green roofs and walls and sustainable urban drainage systems (IUCN, 2017; WBCSD, 2024).

0:4:12.4 --> 0:4:52.564

In addition to our on-site impact, we must think whole life cycle and consider the hidden embodied impact occurring off site associated with raw material extraction, processing, transport, manufacturing, and disposal, including any maintenance and repair. These processes often cause habitat loss, degradation, disturbance, air soil and water pollution, release carbon dioxide and other greenhouse gases contributing to climate change and can introduce invasive species (WBCSD, 2024). One study indicates that as much as 95% of the construction sector's impact on nature is associated with activity off site compared to 5% of impacts occurring at the location of the construction site (Wilting et al, 2017).

0:4:54.744 --> 0:6:14.814

Using the Steel value chain as an example, we can examine materials embodied impact on nature from raw material extraction to disposal on embodied nature impact.

Firstly, the removal of the overburden, including fertile topsoil, rootstocks and vegetation from the mine-site can degrade existing habitats, communities and species (Lamare and Singh, 2017; BHP, 2023). Dewatering mines to access minerals can lead to local groundwater table reductions and increased risk of water scarcity. Extraction operations can pollute surrounding soil and water with solid waste and mine spoils (Ganapathi and Phukan, 2020; HK and Hossiney, 2021; Garlett and Holcombe, 2023).

Secondly, transporting raw materials can impact nature by constructing linear infrastructure like roads and railways, fragmenting habitats and reducing the ability of species to move and migrate (Lucas et al, 2017).

Thirdly, processing and manufacturing releases gaseous pollutants including carbon dioxide, carcinogens, and sulfur dioxide, reducing air quality, and contributing to climate change. Furthermore, waste slag containing ammonia and metal residues can result in soil and water pollution (Li et al, 2015; Chandel et al, 2023).

Finally, as steel is the most common recycled metal due to its high economic value and magnetic properties enabling efficient segregation from mixed construction waste streams,

it does not have the detrimental impacts linked to disposal via landfill or incineration (WBCSD, 2024).

0:6:17.324 --> 0:7:41.194

How is this relevant to you? Firstly, clients are demanding nature positive buildings; to deliver a net positive benefit from nature across a building life cycle, we must consider the upstream and downstream impact of operations. Implementing the mitigation hierarchy to minimize harm and regenerate nature across the value chain (WBCSD, 2024). For example, Arup's one Triton Square (pictured here) reduced embodied nature impacts by championing circular economy principles, maximizing retention and reuse of over 3000 square meters of the existing structure and facade, including limestone, concrete and steel, producing 43% less carbon during construction operation than a typical new build alternative (Arup, 2024)..

Secondly, we must adapt to the changing regulatory landscape, for example, beginning in 2025, the Corporate Sustainability Reporting Directive, or CSRD, will mandate nature and biodiversity disclosures, for companies with a significant presence in the EU or with securities listed in an EU-regulated market (BCG, 2023).

Finally, industry competitors are already capitalizing on the new market opportunities, with many consultancies, including Arup, Arcadis and WSP, adding nature-based solutions, biodiversity, and natural capital advisory to their service offering, prompted by the \$133 billion invested annually in sustainable solutions (WEF, 2021).

0:7:43.854 --> 0:8:26.944

Fortunately, there are many steps you can take today to begin to reduce embodied nature impacts on your projects, for example. You could embed circular practice and design maximize the use of prevailing assets by retrofitting old buildings, reuse existing materials to avoid the extraction of virgin raw materials, design efficiently for longevity and durability, localize the supply chain where possible, assess suppliers for the nature impacts of their products, and adopt corporate policies that encourage upstream transparency.

For further information, consult WBCSD's 'Exploring Nature Positive Buildings Report,' which summarizes additional actions you can take today to reduce embodied nature impacts across your value chains (Arup, n.d; WBCSD, 2023; WBCSD, 2024; TNFD, 2024).

0:8:29.344 --> 0:9:4.24

To recap, to respond to the current nature crisis and achieve the global goal for nature, by 2030, we need a paradigm shift in how we develop the built environment. This means adopting a holistic view of the upstream and downstream impacts of materials whole value chains to consider their hidden embodied impacts, implementing the mitigation hierarchy to avoid, reduce, restore, regenerate, and transform our relationship with the natural world, reducing buildings embodied nature impact. These changes reflect client and regulatory demands and capitalize on new market opportunities.

0:9:5.974 --> 0:9:21.214

So that concludes our session. Thank you for joining. I hope you have found it insightful and are inspired to start acting today. If you want to learn more about these topics, the relevant literature and policy are on the next few slides and feel free to reach out with any questions. Have a fantastic day!

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Part 2: Critical Reflection

What is the chosen medium?

A ‘learning burst’ was selected due to research from the academic and corporate spheres outlining the benefits of ‘micro-learning’ opportunities designed to provide ‘knowledge and information’ on a ‘specific, very narrow topic’ over a short period (8-15 minutes). For example, short videos can contribute to ‘autonomous, collaborative and expansive learning,’ increasing information retention by reducing the cognitive load. Therefore, viewers can maintain higher concentration levels and absorb new concepts without becoming overwhelmed, distracted, or ‘bored (Basarab, 2015; Fujii, 2023).’

Furthermore, the ‘micro-learning’ format was suitable for the ‘time-starved’ audience (building developers and designers), compatible with ‘busy schedules and competing priorities.’ The recording empowered learners since they could control when to ‘stop, rewind

or pause' anywhere with a 'digital device and an internet connection,' facilitating flexible, self-directed learning on a contemporary opportunity/challenge without it feeling forced or intrusive (DeSmet and Plowman, 2015; Eliesha Training, 2024).

That said, a limitation of this medium was the 'passive' learning style, as viewers may retain less information than what is 'simply seen or heard.' To overcome this, I could have included more interactive 'pedagogical design elements.' For example, a formative assessment like a quiz to test knowledge or a discussion board to facilitate asynchronous interaction (Fujii, 2023).

Who is the intended audience, and what is the learning burst's purpose?

The target audience is building developers and designers in the built environment sector, who are responsible for 'preparing or modifying designs for construction projects,' and strategically planning their practical implementation (Health and Safety Executive, 2015). Building developers and designers were selected due to their ability to influence environmental decisions during the preconstruction design phase. For example, by selecting renewable or recycled materials that reduce project's carbon and nature footprint and integrating 'passive sustainable design' elements like natural lighting to reduce energy consumption (Hutter Architects, 2024; Loy, 2024).

The burst intends to raise awareness of the emerging concept of 'embodied nature,' equipping built environment practitioners with the knowledge to shift the current, extractive, linear design paradigm to a regenerative, circular one- compatible with the Global Goal for Nature. The burst addresses some of the prominent barriers hindering the implementation of 'sustainable building designs and practices,' including 'inadequate knowledge and guidelines, poor design techniques and financial restrictions,' by providing immediate, viable suggestions to minimize off-site nature impacts in a free, accessible format (Poorisat et al, 2024). The learning burst complements existing top-down, hierarchical strategies to incorporate sustainability initiatives, like changing regulatory 'legislation,' by providing 'soft, technical skills,' supporting 'ongoing training efforts,' and 'ensuring that sustainability requirements' relating to on-site and off-site impacts on nature are 'fully understood' and 'shared among all project stakeholders.' Helping to cultivate a systemic, bottom-up 'sustainability culture' within organizations (Ferreira et al, 2024).

Why is this topic significant?

This topic is significant because we are experiencing a nature crisis. As the burst highlighted, wildlife populations declined by 69% in the last fifty years, water scarcity increased, and more than a third of soils degraded due to industrial practices (IPBES, 2019; IPCC, 2019). All have severe implications for humanity's ability to survive and thrive.

I first became interested in the 'embodied nature' topic during my industrial placement with Arup, a multinational engineering firm. At work, I undertook a variety of in-depth literature reviews focused on contemporary 'nature positive' discourse and the embodied nature impact of numerous construction materials. I also contributed to the paper 'Exploring nature-positive buildings: Understanding the role of buildings in the transition to a nature-positive future,' which I reference extensively throughout. I developed skills and knowledge relating to storytelling, micro-learning, and 'embodied nature,' which I incorporated in the burst, demonstrating a transdisciplinary approach by bringing professional experience into the academic space.

Furthermore, the topic is significant to my other academic ventures, enabling me to apply a constructivist approach to learning, 'fitting new information together' with ['knowledge and meaning'] I already knew.' For example, my dissertation intends to 'explore environmental inequity embedded in the artificial intelligence hardware lifecycle,' assessing the whole lifecycle of a product (rather than just a raw material) through an environmental justice/ social inequalities lens rather than from a purely environmental standpoint, conveying the notion of environmental inequity 'embodied' within the hardware. Therefore, the SDA provided an opportunity to 'actively construct knowledge,' continuing to 'reflect' on and abstract' information by applying it to new academic contexts (Bada and Olusegun, 2015).

How does the medium reflect the theme of global connections?

Firstly, the medium reflects the theme of 'global connections' by adopting a whole lifecycle perspective to assess the impact of a building on nature across its value chain, emphasizing the hidden or 'embodied' impact that occurs off-site. This echoes week seven's exploration

of 'commodified' nature and globalized supply chains. However, the 'Global Cultural Flows' theme could be more explicit in the learning burst. Although it reiterated the notion of on-site vs off-site nature impacts, it was vague about where these impacts concentrate. To overcome this, I could have emphasized the international nature of material supply chains, including the geographic location of each stage of the steel value chain. For example, raw material extraction occurs primarily in Australia, the United States, Brazil, China, and India (WBCSD, 2024). This additional geographical context would have reiterated the notion of 'green sacrifice zones,' demonstrating that environmentally degrading activities are often externalized to the global peripheries, thereby perpetuating neocolonial extraction patterns (Zografos, 2022).'

Secondly, the medium reflects the theme of 'global connections' by touching on the global scale of the nature crisis and the international response to 'manage' this threat, embodied by the Kunming-Montréal Global Goal for Nature. This parallels week two's work on 'Global Governance, Democracy, and Colonialism.' While not explicit in the burst, the global flow of raw materials (from the peripheries to economic cores) arguably has 'roots in colonialism and colonial power dynamics.' Additionally, the notions of 'shared' responsibility to 'halt and reverse nature loss' are equally as problematic as countries supposedly 'objective' and 'neutral' responsibility to 'protect international peace and security,' considering their differential impact on nature and conflict respectively (Locke et al, 2021; Harsant, 2022). For example, the UK considered itself 'instrumental in driving forward the agreement of the Kunming-Montréal Global Biodiversity Framework (GBF) (DEFRA and Barclay, 2024).' Yet, the Lords Environment and Climate Change Committee report found that it is not on track toward its targets, highlighting the 'substantial and concerning' gap between the amount of effectively protected land at present, which is often in 'poor condition,' and the 30% goal (House of Lords, 2023). Exposing the irony in the 'existing global hierarchies' that promote responsible nature use (Harsant, 2022). However, continuing this line of argument and exploring the topic through a post-colonial lens was beyond the scope of the SDA and outside the sphere of influence of the audience, so redacted from the burst to avoid losing focus and clarity.

What makes the chosen medium and accompanying piece interdisciplinary, and how have different disciplinary insights helped develop ideas?

This SDA employs a transdisciplinary approach to interdisciplinary analysis, creating an ultimately transdisciplinary piece. Mirroring Jahn's theorization that 'trans disciplinaryity sets the frame for a research dynamic that couples societal and scientific progress, [while] interdisciplinarity is the science-driven process of generating the new knowledge (Jahn et al, 2013).'

During my industrial placement, I gained a rich knowledge of the built environment sector and relevant policy and regulation from biodiversity and natural capital specialists. Drawing on lived experience, I could integrate 'knowledge, know-how, and expertise from non-academic [corporate] sources,' to address the nature crisis as a widescale 'societal issue.' A transdisciplinary approach was appropriate considering the 'inherent complexities' of the nature crisis and its 'wicked' traits, capitalizing on the 'substantial knowledge' held by corporate 'societal actors,' unattainable through 'indirect sources, such as media archives, literature, and art (Utrecht University, n.d; Seidl et al, 2013; Lawrence et al, 2022).'

While the burst did not explicitly reference the different interdisciplinary contributions, the analysis benefitted from adopting a 'heterogenous, interdisciplinary, horizontal and fluid' approach to knowledge and data acquisition, compared to a 'homogenous, disciplinary hierarchical' one (Rhoten, 2004). For example, higher education studies inspired the micro-learning format, underpinned by a psychological understanding of cognitive load, attention span, and memory. Secondly, using corporate governance frameworks, the burst facilitated an organizational, bottom-up mindset shift to embrace more sustainable practices. Finally, the content of the burst, including definitions of nature, a contemporary overview of the 'crisis,' and on-site and embodied impacts on flora and fauna, were sourced from numerous natural science disciplines, including earth sciences, ecology, and sustainability science. Additionally, combining information from peer-reviewed journals with grey literature (like corporate white papers) reflected the contemporary understanding of the topic from an academic and corporate perspective.

The learning burst bridged the 'gap' between theory and tangible, 'project reality,' fostering 'closer cooperation' between organizations and academia due to its creation within the

academic sphere for dissemination in the corporate one. Therefore, challenging the corporate notion that academia delivers only 'theoretical,' 'proposed' solutions that 'lack practical experience,' and demonstrating that academia needs to be 'reorientated' to actively 'involve stakeholders' (including corporate organizations), achieving a better balance between disciplinary and interdisciplinary research (Seidl et al, 2013; Ferreira et al, 2024).' However, the need for interdisciplinary collaboration could have been reiterated in the burst, rather than presenting built environment practitioners as a siloed group. For example, the holistic connections between environmental specialists, procurement, and other supply chain stakeholders, would encourage the audience to engage in richer communication and lobby for greater transparency in the supply change, enabling long-term industry-wide transform.

How has this project helped progress learning?

This project progressed my learning by encouraging me to reflect on my audience, making them 'exceptionally clear,' and ensuring that the 'intended delivery' is successful by adapting my 'tone, style and vocabulary.' Previously, I found it challenging to write for a non-academic audience, using overly technical language which may have intimidated viewers and led to disengagement or confusion. Subsequently, I focused on using plain language, defining key terms, not assuming prior knowledge and incorporating the steel case to illustrate and simplify an otherwise technical concept (LinkedIn, 2023).

Furthermore, I enjoyed learning about the topic since it encouraged me to consider other 'invisible' impacts of material value chains. I was 'energized' to read, paid closer 'attention' to the literature, and could retain and 'process information' more effectively. As Harackiewicz suggests, this 'interest' led to 'momentary experiences of captivation,' and a lasting feeling that the subject is 'enjoyable and worth further exploration' in future research (Harackiewicz et al, 2016). Also, throughout the project and the module, I developed a cynicism towards large, international institutions (often with embedded colonial histories) failing to deliver on ambitious environmental and social targets. Previously, my worldview hinged on a general acceptance of institutional dominance and moral superiority in a state of 'blind faith,' undermined by implicit bias and ignorant of the numerous existing

neocolonial systems. I conclude this project with a fresh perspective and an imbued confidence to 'challenge the governance dysfunction we currently experience in many national contexts and within global governance institutions (Naidoo, 2004).'

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