(A)mending Architecture Education in the Climate Emergency: a focus on values and cultures

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Abstract

Research on architecture education in the climate emergency is heavily action focused: while there is a vast body of research around sustainability knowledge and an increasing amount of research on teaching methodology and pedagogy, there is a limited amount of research focusing on the values and cultures that architecture education operates through and promotes, and their connection to unsustainable professional practices. Drawing from interdisciplinary scholarly debates, this paper explores broader societal value systems which have formed the foundations of unsustainable values and cultures in architecture, and mirrors them against the key values, cultures and pedagogies of the architectural design studio. The Modernist ideals of rationalism, logic and positivism have justified the separation of humans and nature and have validated the exploitation and oppression of nature and vulnerable communities for profit and the accumulation of capital. In architecture education, this worldview has promoted transmissive approaches to learning, forming hierarchical and exclusive cultures around the acquisition of skills and knowledge. Instead, architecture education should transition towards a **holistic** worldview that does not separate humans from nature, but instead highlights the interconnectedness and interdependence of all life without overlooking the responsibilities that only humans can carry out in caring for the environment. Drawing from the field of environmental education, the approach we suggest promotes critical thinking and reflection with collaborative and inclusive learning cultures fostering mutual dialogue and critical attitudes.

Keywords: architecture education, values, climate emergency, sustainability, design studio, educational reform, teaching, critical thinking, collaborative learning.

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"We are not short of knowledge on sustainability principles or sustainable design approaches, and yet this has not led to the mainstreaming of sustainable architecture."

Introduction

Human development has destabilised Earth's systems and broken planetary boundaries (Rockström et al., 2009), resulting in e.g., the twin crises of climate change and biodiversity loss. The concept of **climate emergency** highlights the urgency and scale of action needed to hinder and prevent further, potentially irreversible damage to the Earth and its life-sustaining web (IPCC, 2023). In architecture, the discussion around the climate emergency is, unsurprisingly, heavily action focused: what can we as designers *do* to adapt to and mitigate the effects of the climate emergency. This typically translates into talking about solutions: correct design decisions and approaches, or in education the right kind of design briefs, and design tasks for students to tackle. However, we are not short of knowledge on sustainability principles or sustainable design approaches, and yet this has not led to the mainstreaming of sustainable architecture (Nisonen & Pelsmakers, 2022). Often sustainability is still treated as a distinct topic separate from the architectural design process or its desired outcome (Donovan & Pelsmakers, 2019; Tucker, 2021; Nisonen & Pelsmakers, 2022, O'Dwyer et al., 2023).

The climate emergency and unsustainable architecture are increasingly understood as systemic problems, comprising of multiple complex and intertwined levels, where concrete actions are only the tip of the iceberg: values, cultures, and norms form the foundations of all actions and behaviours (Monat & Gannon, 2015; Sterling, 2013 & 2021). These complex and intertwined levels can be studied through **systems thinking,** a holistic approach to analysis that focuses on the interrelationships between the different parts of a system. According to systems thinking, goals and values shape the everyday actions of individuals, and in return, these actions shape the system the actions happen in (Sterling, 2013; Monat & Gannon, 2015) – see Table 1. Moreover, Sterling (2013, 2021) argues that an understanding of these interrelationships is a prerequisite for transformation and development: without a profound understanding of a system (e.g., higher education) and its driving values and cultures it is likely that actions taken to tackle e.g., unsustainability remain surface-level and strive to work within existing purposes, policies and structures, when typically a deep transformation requires changing the purpose or functioning logic of a system, i.e., the whole system itself.

values	cultures	norms	actions
core values and beliefs that keep the system stable	*traditions, origins & relationships*	*patterns of behaviour & recurring events*	*observable behaviours and events*
why does it keep happening?	*why is it happening?*	*what has been happening?*	*what is happening?*

Table 1. System thinking model. Adapted from Sterling et al., 2013.

While an unsustainable system will not allow for holistically sustainable actions to emerge, unsustainable actions can also turn an entire system unsustainable. After all, "actions intended to be sustainable, with unsustainable consequences, are not truly sustainable" (Nisonen & Pelsmakers, 2022). For example, replacing a self-organised community garden with a new apartment building made out of low-carbon materials will never justify the loss of agency and a shared, safe place for the broader community. Moreover, without adequate compensation through restorative and regenerative design of new green infrastructures, the effects to urban biodiversity would be negative, if not devastating.

Systems thinking also applies to education: values and cultures transmitted through education form the foundation of one's knowledge, worldview and mechanisms of meaning-making (Värri, 2018; Cantell et al., 2020; UNESCO,

2020). And in the context of professional education, the foundation of one's professional practices.

While there is a vast body of research around the sustainability *content* delivered through architecture education (e.g., Boarin & Martinez-Molina, 2022, O'Dwyer et al., 2023), as well as an increasing amount of research on specific teaching methods or teaching interventions (in the form of case studies) as well as teacher perceptions of students' sustainability related skills and competences (Grover et al., 2017, 2018, 2019; Boarin & Martinez-Molina, 2022; O'Dwyer et al., 2023), there is still a very limited amount of research focusing on the deeper systemic levels of architecture education. The values and cultures that architecture education operates through and promotes, and their connection to unsustainable professional practices, remain largely unexplored, highlighting architecture's action-oriented approach to sustainability (Grover et al., 2018; Boarin & Martinez-Molina, 2022). However, a vast body of literature from different disciplines exists around the characteristics of systems and frameworks that result into (un)sustainable actions or outcomes (e.g., Kahn, 2008; Burns, 2011; Sterling, 2013 & 2021; Moore, 2019; Blanco-Wells, 2021; Núñez-Andrés et al., 2022).

Hence, our main research question centres around "What values and cultures prevent or support holistic sustainable architecture education?". In the context of this research "holistic sustainable architecture education" refers to education that promotes a comprehensive, systemic consideration of sustainability (UNESCO 2020) i.e., *supports* forming a critical understanding of the values one operates on, *functions* through sustainable learning and teaching cultures and *supports* the acquisition of knowledge, skills and competences necessary for sustainable actions in one's work and everyday life.

To answer this research question, this paper brings together insights on values and cultures that have been identified to promote (un)sustainability in other disciplines and compares them with the dominant practices and tradition of the architecture education discipline. The aim is to identify problematic professional values and cultures and possible ways to (a)mend them.

First, the methods used in this research are described. Second, broader societal phenomena are explored to unveil the foundations of unsustainable values and cultures in architecture education. Following this, key concepts of learning related to values and cultures are introduced. After this the key learning environment in architecture education – the architectural design studio – is introduced, and its key values, cultures and pedagogies are compared to the findings from previous parts. Finally, approaches for (a)mending harmful and unsustainable (learning) cultures are suggested drawing from best practice principles for the promotion of sustainability in teaching and learning.

Methods

The insights presented in this paper draw from a traditional (narrative) literature review mapping interdisciplinary scholarly debates on (un)sustainable (architecture) education with a focus on values and culture. The reviewed literature was retrieved throughout the research process using keyword searches and by snowballing references of the most relevant literature. Given the broad topic area and a profound lack of previous research around the theme of this paper (Boarin & Martinez-Molina, 2022, O'Dwyer et al., 2023), a systematic or scoping literature review was not within our reach (Grant & Booth, 2009). Instead, we engaged with the literature that seemed most relevant to us to, firstly, gain a holistic and critical understanding of recent discussions, trends, phenomena and knowledge in different disciplines, secondly, make comparisons and connections within this interdisciplinary literature with relevance to architecture education, and finally, answer the research question.

To answer the research question, the literature was divided into three categories through qualitative content analyses (Schreirer, 2012), 1) broader context, 2) educational context and 3) discipline-specific context. Under these, we identified four interconnected sub-categories: broader societal origins, critical frameworks, educational concepts and approaches and practices of architecture education. These sub-categories were further characterised through keywords. Most articles fit into multiple categories and under several keywords. Table 3 presents the **primary** categories and keywords. Interconnections between the categories and their implications in the context of architecture education are explored in the following sections.

While a traditional literature review can be regarded as subjective (Grant & Booth, 2009), bias was minimised by the use of keyword searches across different fields and through the categorisation of themes (as listed in Table 3). It is also noted that the resulting categorisation and conceptualisation of the research context is not the endpoint but the starting point for further research to build on and further test its validity.

RQ: What values and cultures are preventing or supporting holistic sustainable architecture education?			
broader context		*educational context*	*discipline-specific context*
broader societal origins i.e., values, cultures and phenomena fuelling (un)sustainability	*critical frameworks* for observing traditions, origins and relationships behind (un)sustainability	*educational concepts & approaches* for addressing (un)sustainability	**practices of architecture education** i.e., the nature, key pedagogies and key methods of architecture education
Anthropocene & Capitalism (Mangold, 2010; McBrien, 2016; Moore, 2017. 2019; Yusof & Kozlowski, 2015) **Exploitation, oppression** (Bryan, 2022; Keet, 2014; Rockström et al., 2009, 2023; Sullivan & Tuana, 2007; Tucker, 2021) **Modernism** (Abel, 2004; Boetto 2018; Kegan, 2018; Till, 2007, 2017; Ward, 1991	**Feminist research** (Blanco-Wells, 2021; El Kassar, 2018; Fox & Alldred, 2020; Nelson & Power, 2018; Plumwood, 1993; Ruder & Sanniti, 2019; Tuana, 2016, 2017) **Political Ecology** (Aedo et al., 2019; Burke & Shear, 2014; Ernstson & Swyngedouw, 2018; Lloro-Bidart, 2015; Svarstad et al., 2018) **Systems Thinking** (Monat & Gannon, 2015; Rittel et al., 1974; Sterling, 2021, 2013a, 2013b)	**Worldviews** Alhadeff-Jones, 2012; Essomba et al., 2022; Smitsman et al., 2019 **Approaches to learning** Aboytes Rodríguez & Barth 2020; Brookfield, 2012; Burns, 2008; Kegan, 2018; Kolb, 2014; Kondrad et al., 2021; Lindblom-Ylänne & Nevgi 2009; Merriam & Kim, 2012; Mezirow, 2012, 2018; Núñez-Andrés et al., 2022; Perkowska-Kleiman, 2022; Stewart, 2013 **Environmental education** (Argento et al., 2020; Alsop et al., 2007; Barrett et al., 2017; Bosone et al., 2022; Burns, 2011; Cantell et al., 2020; Harrison, 2010; Huttunen et al., 2021; Kahn, 2008; Littrell, 2020; Livingstone, 2020; Misiaszek, 2020; Monroe et al., 2019; Ojala, 2021; Reddy, 2021; UNESCO, 2020; Värri, 2018; Wodika & Middleton, 2020)	**The architectural design studio** (Atekpe, 2022; Boarin & Matrinez-Molina, 2020, 2022; Barrows, 1996; Bridges, 2006; Chan & Sher, 2014; Deutsch, 2020; Drinan, 1991; Engel, 1991; Furniss, 2020; Hmelo-Silver, 2004; Gropius, 1975; Grover et al., 2017, 2018, 2019; Kelly, 2021; Lawson, 2019; Maitland, 1991; McLaughlan et al., 2021; Nisonen & Pelsmakers 2022; Nisonen, 2022; Nisonen et al, n.a., O'Dwyer et al, 2023; Olweny, 2023; Pelsmakers et al, 2020; Pelsmakers et al., 2021; Salama, 2021; Schön, 1991; Tan, 2017)

Table 3. The primary categories and keywords of the reviewed literature established through qualitative content analyses.

Findings in the sections below are discussed in relation to these categories.

Broader context

This section unveils **broader societal origins** of unsustainable value systems, cultures and phenomena through viewpoints from **critical frameworks** such as feminist research and political ecology. First, the concepts of the **Anthropocene** and **Capitacloene** are touched upon, and the role of **Modernism** is explained. Then, broader cultures of **exploitation** and **oppression** are explored through concepts such as othering, dichotomies and ignorance. Finally, the connection of these concepts to the field of architecture is established though further exploring the legacy of modernism.

Increasingly, research on the fundamental causes of the climate emergency is moving beyond the "Anthropocene", an era of harmful human actions affecting our planet, its ecosystems and its climate towards more nuanced views. where it's suggested that since not all humans have equally contributed to the **exploitation** of our planet, questions of **power and justice** should be highlighted (Tuana 2016, 2017; Moore, 2017 & 2019; McBrien, 2016; Värri, 2018; Huttunen et al., 2021; Ruder & Sanniti, 2019).

It is widely agreed upon that the climate emergency is inseparably linked to fundamental, global imbalances of power, and to the exploitation of both vulnerable communities and nature around the world, yet more intensely beyond the Global North as a legacy of colonialism (e.g., Mangold, 2010; Fraser, 2015; Yusof & Kozlowski, 2015; McBrien, 2016; Tuana, 2016; Moore, 2017, 2019; Ruder & Sanniti, 2019; Blanco-Wells, 2021; Tucker, 2021). This culture can be traced back to the global rise of **capitalism**, an economic and political system based on the private ownership of means of production and their operation for profit, enabled by the fossil-fuel industry and the exploitation of natural resources (Brookfield, 2012; Boetto, 2019; Blanco-Wells, 2021; McBrien, 2016). Instead of the "Anthropocene", the concept of **Capitalocene** depicts this imbalance of power (McBrien, 2016; Moore, 2017).

The capitalocene originates in **Modernism**, a philosophical movement borne out of the transformation of socio-cultural attitudes in the early 1900's. Modernism rejected the ideas of determinism, tradition and authority and aimed to transform the Euro-Western society by introducing a value system based on nihilism, (i.e., the rejection of established and/or religious moral codes) rationality, logic and positivism (Kegan, 2018; Värri, 2018; Boetto, 2019). These changes paved the ground for the emergence of the modern Euro-Western society and its key phenomena, such as technological development, industrialisation, urbanisation, capitalism, and the market economy. Moreover, at the time, the rise of individualism and independence empowered people to challenge the status quo and to stand against traditions, conservative authority and oppression (Abel, 2004). Despite its undeniable merits around unprecedented advancements in science, art, politics and philosophy, Modernism introduced several problematic phenomena with far-reaching consequences.

The pursuit of modernism's ideals justified the exploitation of nature and humans through a **positivist** assumption that nature is a controllable, rational entity separate from humans and which can thus be factually described and rationally managed (Ruder & Sanniti, 2019; Boetto, 2019; Fox & Alldred, 2020). This assumption is still widely accepted in contemporary Euro-Western societies and used to justify the ways in which natural resources are intensely exploited and overconsumed e.g., in the form of food production units, agricultural plantations, and different kinds of built environments (Tuana, 2017; Ruder & Sanniti, 2019; Blanco-Wells, 2021). This is justified through the aim of advancing the modern society and its (technological) innovations related to human needs and wants, which can also be understood in terms of **greed** as Burke and Shear (2014,

p.129) frame it: "The dream of progress and prosperity [profiting] the world's biggest banks".

From the literature, the concepts of **othering** and **dualism** are considered key for understanding the exploitation and oppression of nature. Only when something is seen as "other" or separate from us can its domination be justified (e.g., Keet, 2014; McBrien, 2016; Ruder & Sanniti, 2019; Misiaszek, 2020). **Othering** is a process of estrangement and separation where one entity is labelled as dominant, superior or primary, and "the other" as its lesser opposite (e.g., human-nature, self-other, reason-emotion), often downplaying the "other's" diversity through stereotypes and generalisation (Keet, 2014; Tuana, 2017; Ruder & Sanniti, 2019). Othering is closely connected to the concept of **dualism**, a process where contrasting concepts are juxtaposed by characterising one as dominating and one submissive, and by describing these concepts as oppositional and exclusive (Plumwood, 1993; Lloro-Bidart, 2015; Fox & Allred 2020; Blanco-Wells, 2021). These contrasting pairs can also be referred to as **dichotomies**. Othering and the creation of dualistic dichotomies has justified and normalised (physical or figurative) violence against oppressed humans, nature and the planet (Tuana, 2016; Ruder & Sanniti, 2019; Fox & Alldred, 2020). This practice has also normalised Euro-Western, rational and technocratic ways of knowing, actively invalidating differing views (e.g., emotion, intuition and indigenous ways of knowing) (Keet, 2014; Tuana, 2017).

The critique of dualist thinking should not, however, misplace the **duality** embedded in human existence. While humans are always part of the environments where they dwell – including nature's ecosystems but also cultivated and built environments – they simultaneously form, in contrast to other living beings, **culturally conditioned relations** with their living environments. In philosophical anthropology, Helmuth Plessner (2019) terms this environmental relationship **"excentric"**, in distinction from the "centric" environmental relations that other animals form.

While centric relations are formed and lived in the here-and-now, in a direct embodied manner, excentric relations are informed by broader existence in time and space. To illustrate, a simple example of this distinction can be found between the dog – one of the most culturally embedded animals – and the human. When the dog and the dog owner encounter a transformation in urban space on their daily walk, say a new statue in the park, the dog encounters a new physical element that can be explored by **sensing**, while the dog owner sees a piece of art that resonates with **everything they know** about such art. Their potential affection, or perhaps disgust, towards the statue is thus based on a completely different kind of assessment, which directs their future agency when visiting the park. This does not mean that, when dwelling in the park, the dog and the human are not part of this environment as embodied beings; it is only that their dual relationships with the environment are formed differently, i.e., centrically and excentrically. Furthermore, this excentric relationship shouldn't be seen as "superior", but rather a further justification to why humans should **care for** and hold a greater **responsibility** in how we treat spaces and places, as we are able to consciously place our actions in broader (societal) contexts.

Besides othering, **ignorance** (both accidental and deliberate) is closely connected to justifying unsustainable values, cultures, and actions. Sullivan & Tuana (2006) argue that in addition to ignorance that stems from lack of knowledge, a state that is most likely accidental and can easily be mended, there are several other forms of ignorance. The broader, complex phenomenon of ignorance can be referred to as the "epistemologies of ignorance" (Sullivan & Tuana, 2006; Tuana, 2017; El Kassar, 2018; Ruder & Sanniti, 2019). Besides a lack of knowledge, ignorance can be the result of deliberate efforts to keep power positions stable or to justify oppression: access to information or something

previously known may be obstructed, or people may consciously refuse to receive information. Ignorance can also be a defence mechanism or a survival strategy of those who are or feel oppressed. (Keet, 2014; Tuana, 2017.) In the context of the climate emergency, ignorance – or its radical cousin denial – are common defence mechanisms for individuals, employed when the threat of the climate emergency feels too proximate and impossible to process (Ojala, 2021; Bosone et al., 2022).

Additionally, it has been noted that oppressive systems tend to generate systemic ignorance (Sullivan & Tuana, 2007): in systems where top-down power positions normalise certain discourses to keep the system stable, alternative voices and narratives are overlooked or deliberately silenced (Keet, 2014; Tuana, 2017). To illustrate, Euro-Western capitalist societies' tendency to highlight human reason and rationality and to "other" nature and emotion, has led to systemic ignorance towards e.g., planetary boundaries and social justice (McBrien, 2016; Tuana, 2017; Värri, 2018; Ruder & Sanniti, 2019).

While **political ecology** and related research has explored the problematic value systems and mechanisms of power related to human-environmental relations in the world of global capitalism over several decades (Burke and Shear, 2014; Svarstad, Benjaminsen, & Overå, 2018; Ernstson & Swyngedouw, 2018), only recently has such research started to become more mainstream across various disciplines. Interesting views are being developed in fields such as **social ecology** and **ecofeminism,** for instance, to study and unveil these mechanisms that "reinforce the domination, exploitation and oppression of Others" (Ruder & Sanniti, 2019).

Table 4 synthesises key interconnections regarding unsustainable societal values, cultures and norms from concepts discussed above through a system thinking model.

values	cultures	norms	actions
core values and beliefs that keep the system stable	*traditions, origins & relationships*	*patterns of behaviour & recurring events*	*observable behaviours and events*
why does it keep happening?	*why is it happening?*	*what has been happening?*	*what is happening?*
logic and rationality	anything in the material world (e.g., the more-than-human nature, behaviour or thinking) can be understood and managed	Logical and linguistic intellect is highlighted	Valuing reason and logic over emotion and intuition
positivism	nature is separate from humans nature is a controllable, rational entity nature serves human development	Socio-cultural mechanisms of estrangement (e.g., othering, dualism, dichotomies, epistemology of ignorance)	the exploitation of nature and natural resources biodiversity loss and
individualism	the human individual has an intrinsic worth and is primary	Preference of individual capability	Top-down power structures

Table 4. Unsustainable values, cultures and norms presented through a system thinking model.

Unsurprisingly, architecture is no stranger to the socio-cultural mechanisms described earlier (e.g., Grover et al., 2017, 2018, 2019; Mangold, 2010; Till, 2020; Kelly, 2021; Tucker, 2021). Architecture reflects and spatialises the value systems it exists in; the separation of humans and nature and the western values of rationality and individualism have informed and validated theories and

professional cultures in architecture, which in turn have manifested into physical spaces and places that reflect these values (Ward, 1991; Mangold, 2010; Tucker, 2021). To illustrate, drawing from the principles of Modernism, **Bauhaus** introduced the concept of "design" by combining arts, crafts, technology, and society to create rational, practical and functional designs to serve people's everyday life (Abel, 2004; Bridges, 2006; Furniss, 2020). Issues and inconveniences in people's everyday lives were to be solved through the creation of technological solutions in the form of physical objects and spaces. Moreover, in architecture this manifested into the idea of using design as a tool for "social engineering", i.e., to improve society and human behaviour with the architect making the decisions and representing the users without directly involving them (Ward, 1991; Grover, 2018; Till, 2021). A key aim was to standardise or mass-manufacture these solutions (Abel, 2004).

The use of fossil fuels and the global extraction of natural resources enabled rapid advancements in material technology throughout the 20th century, accelerating standardisation and mass-production. This in turn diminished the cost of construction and led to innovations that were at the heart of modern architecture and still characterise architectural form, material choices and spatial structures today (Mangold, 2010). However, in the Capitalocene the built environment is typically created as an investment for those with the capital, and consequently architecture has turned into a financial instrument for profit that fails to recognise the diversity of users, their needs and their agency, including e.g., plants and non-human animals as living organisms. Mass-production, standardisation and the low cost of building have primarily served to ensure even larger profits (Abel, 2004).

These examples highlight the deep interconnection between architecture (education) and the broader societal context within which it exists. Drawing from the body of literature reviewed in this section, two key dichotomies were identified that seemed to be at the core of the broader societal origins of unsustainability: **exclusivity–inclusivity** and **individualism–collaboration** (table 5).

dominant / mainstream	submissive / alternative
exclusivity	inclusivity
individualism	collaboration

Table 5. The two key dichotomies identified in this research preventing sustainability.

These dichotomies are gradually, yet likely unconsciously or unintentionally, internalised in both, one's everyday life but also through education (e.g., Tan, 2017; Värri, 2018; Boarin & Martinez-Molina, 2022; Olweny, 2023). To better understand how this internalisation happens through education the following sections will, first, introduce educational concepts related to internalising values and cultures through education. After that, their application in the key learning environment in architecture education, the architectural design studio, is explored in detail. Finally, approaches for dismantling these dichotomies are explored through good-practice examples drawn especially from the field of environmental education.

Educational Context
This section defines key educational concepts related to the interconnection of values, cultures and learning. First, the role of **worldviews** is explored, and later their connection to **approaches to learning**. Further, the connection of these concepts to (un)sustainability and is explored in more depth. Finally, the relationship of these concepts to architecture education is discussed.

Worldviews

The climate emergency is a deeply intertwined and complex problem that cannot be "solved" with any particular, single solution. Exploitation of nature and extraction of natural resources still fuels all levels of contemporary society from values to actions. Cultures of exploitation and estrangement are deeply engrained in the ways people think and behave; broader societal value systems gradually become a part of an individual's self-perception and identity and make them nearly inseparable (Mezirow, 2012; Merriam & Kim, 2012). Hence, the climate emergency is not only complex in itself but also entangled with the identities and behaviours of millions of people worldwide.

This idea of **complexity** fundamentally challenges the rationalist and logical (also referred to as **mechanistic**) value system and worldview of the Euro-Western society (Alhadeff-Jones, 2012; Keet, 2014; Tuana, 2017; Ruder & Sanniti, 2019). It also challenges education: a transition away from rationalist and logical ideals changes the way learners and the process of learning should be seen (Värri, 2018). These changing ideals can be observed through **worldviews.**

Mechanism, a worldview closely connected to Modernist ideals and positivism, refers to the assumption that anything in the material world, including entities like nature, behaviour or thinking, can be understood and managed through mechanical laws (Burns, 2009; Smitsman et al., 2019; Sterling, 2021). In education this manifests in the ways learners are viewed and how teaching is approached: from a mechanistic point of view, the learner is seen as a cognitive, individual being with incomplete knowledge and with logical and linguistic intellect (Smitsman et al., 2019). The goal of learning is to fill in the learner's knowledge gaps by providing them with pre-defined and curated bodies of knowledge to internalise, and for them to develop their individual capability as learners. Even though learners are seen as individuals, differences amongst learners are seen to mostly relate to their different levels of knowing, which means that their contextual environmental relation forming in the flow of everyday life is overlooked. In this approach, the main role of the educator is to act as a subject expert (Burns, 2009; Ruder & Sanniti, 2019).

Holism, in contrast, embraces complexity. A holistic worldview assumes that all life and all systems are complex and interconnected and cannot be fully understood or managed (e.g., Burns, 2009; Blanco-Wells, 2021; Essomba et al., 2021). From a holistic perspective, the learner can be an individual, a group, a community, or an organisation with a range of needs and emotions. Instead of a lack of cognitive knowledge, contextual and intersubjectively forming *beliefs and feelings* form the starting points of learning. Learners are seen to differ from one another, and their intuition, capabilities and multiple intellects (i.e., not solely logical or linguistic intellect) are valued respectively. This approach marks teachers as reflective beings with different potential roles in different situations. (e.g., Burns, 2009; Kolb, 2014, Cantell et al., 2020).

Opposing many of the key Modernist ideals, holism is currently gaining ground in Euro-Western education and related research (Burns, 2009; Fox & Alldred, 2020; Blanco-Wells, 2021). Critical research suggests that to confirm the narrative of the Euro-Western rationality, discourse around holistic thinking has been deliberately downplayed and invalidated for decades (Keet, 2014; Tuana, 2016, 2017). Some research has also pointed out that, since holism is closely connected to e.g., indigenous ways of knowing, it was othered in order to justify the oppression and exploitation of vulnerable communities and natural environments outside Euro-Western contexts (Tuana, 2017; Nelson & Power, 2018; Ruder & Sanniti, 2019). In response, fields like systems thinking have, for instance, highlighted the necessity of holistic thinking in the climate emergency and striven to validate it as a part of contemporary Euro-Western ways of knowing (Sterling, 2021).

Approaches to learning

Worldviews inform the way teaching and learning are understood and defined. Stemming from these worldviews, all learning environments represent an **approach to learning** or combine several different approaches, which determine the role of the learner and the educator in a learning environment and often characterise the nature of knowledge (Burns, 2009; Lindblom-Ylänne & Nevgi 2009) – see Table 6. The nature and number of these approaches depend on the values and the purpose of the learning environment itself, as well as on the previous learning experiences of the educators and learners. They are typically tied to worldviews and informed by broader societal value systems and ideologies. Thus, learning environments are central to what kind of values and cultures learners internalise (Värri, 2018).

A mechanistic worldview typically results in transmissive or transactional approaches to teaching (Burns, 2009, 2011; Perkowska-Klejman., 2022). **Transmissive** learning refers to a teacher-centric, hierarchical approach where communication is one-way and aims to transfer knowledge from teacher to student. This approach draws from **behaviourism,** an approach to learning where learning is seen as a process of imitation and mirroring, and a learner as a "tabula rasa", objectively internalising new information without personal interpretation (Stewart, 2013; Lindblom-Ylänne & Nevgi, 2009). **Transactional** learning refers to two-way communication and sharing of knowledge between teachers and students. This approach can be seen to draw from **constructivist** learning theories where the role of social interaction, knowledge creation and understanding of processes (e.g., problem solving) are emphasised (Lindblom-Ylänne & Nevgi, 2009).

A holistic worldview, instead, supports a **transformative** approach to learning, i.e., it strives to support the transformation of learners' worldviews, values and attitudes towards more inclusive ones by acknowledging their existing ways of knowing, believing and feeling (Burns, 2008; Aboytes Rodríguez & Barth, 2020).

Transformative learning refers to learning as a participatory and holistic process where knowledge is dynamically created among everyone in a learning environment through sharing versatile perspectives and critically evaluating existing paradigms (e.g., Mezirow, 2012 & 2018). The transmissive and transactional approaches focus on the interaction between teachers and students, whereas transformative learning emphasizes the need for collaboration between peers, educators, and external stakeholders (Burns, 2009, 2011; Lindblom-Ylänne & Nevgi, 2009; Kolb 2019; Mezirow 2018).

Table 6 synthesises the characteristics of transmissive, transactional and transformative approaches to learning described above. It describes their relationship to the role of the learner and educator as well as to the nature of knowledge. It also presents the connection of these learning approaches to related learning theories.

	transmissive	transactional	transformative
approach to learning (Miller & Sellers, 1990)	transmission of knowledge, attitudes & skills: behaviorism	learner's growth and development & problem-solving capacity	personal growth & meaning making, holistic thinking
***examples of related learning theories** (Lindblom-Ylänne & Nevgi, 2009)*	***Conditioning*** *(Ivan Pavlov, John B. Watson),* ***Social learning*** *(Albert Bandura)*	***Cognitive constructivism*** *(Jean Piaget, Jerome Bruner),* ***Social Constructivism*** *(John Dewey)*	***Experiential learning*** *(David Kolb),* ***Transformative Learning*** *(Jack Mezirow),* ***Critical Pedagogy*** *(Paolo*

			Freire) & **Humanistic learning theory** *(Carl Rogers, Abraham Maslow, Malcom Knowles)*
role of the learner & educator	educator control: educator as they authority of knowledge	shared control between educators and learners	learner control (as much as possible)
approach to knowledge	knowledge is established	knowledge is a combination of both established & personal knowledge, focus on knowledge exploration and verification processes	personal knowledge as a filter through which established knowledge is processed; knowledge construction and critical reflection

Table 6. Transmissive, transactional, and transformative approaches to learning (Miller & Sellers, 1990; Lindblom-Ylänne & Nevgi, 2009; Burns, 2009; Nisonen, 2022)

Transmission and transaction are suitable methods when teaching aims to increase students' cognitive understanding of a topic and introduce them to the basic principles of a discipline, or when skills are transmitted (Burns, 2009, 2011; Aedo et al., 2019). These approaches may, however, fail to address the complexity of real-life problems as they need to be simplified to ensure fast-paced learning.

When it comes to the issue of architectural design in the context of climate emergency, we argue that transmission of knowledge and learning through transactions is not enough (also Nisonen 2022; Nisonen & Pelsmakers, 2022). Students need to learn to critically evaluate the dominant values, cultures and norms, and question both the starting points and the anticipated end-result of their work (e.g., Burns, 2011; Grover et al., 2018; Kelly, 2021; Tucker, 2020). This can be achieved, for example, through a transformative approach to learning, where established bodies of knowledge are deliberately questioned and critical reflection encouraged (e.g., Burns, 2011; Värri, 2018; Monroe et al., 2019; Cantell et al., 2020; UNESCO, 2020; Ojala, 2021; Bryan, 2022).

Typically, professional education, including architecture education, builds on a mechanistic worldview and a rationalist and pragmatic pedagogical point of view (Grover et al., 2019, Boarin & Martinez-Molina, 2022; O'Dwyer et al., 2023). This manifests as a focus on the "what" and the "how" i.e., learning where "the goal is to improve actions to reach a desired outcome" (Nisonen, 2022). In architecture education this is visibly through a globally dominant teaching approach where students' learning is structured around completing (pre-defined) design tasks (Bridges, 2006; Pelsmakers et al., 2021; Boarin & Martinez-Molina, 2022; Park et al., 2022; O'Dwyer et al., 2023). Traditionally these processes of discovering the "what" and the "how" are fairly linear: there are certain steps to be taken and certain bodies of information to be obtained and internalised to inform the process (Hmelo-Silver, 2004). Transmissive and transactional learning support this goal by explaining (often tacit) processes of cause and result: what happens if something is or isn't done in a certain way.

Learning that focuses on the "what" and the "how" typically strives to keep a system stable by informing learners on how to do something "right" or in an established and accepted manner (Sterling, 2013; Värri 2018). However, learning that only strives to keep a system stable is nowadays considered insufficient, as the climate emergency calls for the questioning of established (unsustainable) values, cultures and everyday practices (e.g., Lloro-Bidart, 2015; Värri, 2018; Monroe et al., 2019; Boetto 2019; Cantell et al., 2020; UNESCO, 2020; Bryan, 2022).

Learning that serves to change a system doesn't solely focus on the "what" and the "how", but also on the "why": it strives to understand both the operating mechanisms of a system (**what, how**) *and* the very reason(s) **why** the system operates in the first place. The way transmissive and transactional education fail to address the "why" can be seen as (deliberate or accidental) ignorance towards complexity, or a (deliberate or accidental) gesture to prevent learners from questioning a system (Ruder & Sanniti, 2019; Tuana, 2017) – or simply, to make educational processes fast and resource-efficient.

As the climate emergency is a complex and systemic tangle of "wicked problems" (Rittel, Melvin & Webber, 1974) that no single field has caused, no single field can (a)mend it. Mitigating the effects of the climate emergency calls for interdisciplinary collaboration beyond traditional disciplinary boundaries and the pooling of skills (e.g Chan & Sher, 2014; Yusof & Kozlowski, 2015, Sterling et al., 2013; Till, 2020, Kelly, 2021). The key issue with mechanistic, transmissive and transactional learning is that, first, these approaches tend to support and promote silo-thinking, and second, they struggle to embrace the complexity of real-world problems, reducing them into issues that only a single field could or should address. Expanding learning to the "why" helps incorporate interdisciplinary perspectives and paves the way for a holistic and transformative learning culture (Boetto, 2019; Sterling, 2021; Essomba et al., 2022; Bryan 2022).

The following section explores how different **worldviews** and **approaches to learning** are visible in the discipline-specific context of architecture education and how they may affect unsustainable professional practices.

Discipline-specific context

This section explores and describes the practices of architecture education, especially the purpose, underlying values and key pedagogies of the key learning environment in architecture education, i.e., **the architectural design studio**, and the social culture the design studio transmits and supports. These insights are mirrored against the concepts **worldviews** and **approaches to learning** unfolded in the previous section and further expanded by connecting them to **broader societal origins** of (un)sustainability explored in the first section.

The architectural design studio

The architectural design studio (from now on referred to as "the design studio") is the dominant pedagogical model in architecture education worldwide (e.g., Grover et al., 2018; Pelsmakers et al., 2020; Boarin & Martinez-Molina, 2022; O'Dwyer et al., 2023). Since the Bauhaus theories introduced the concept of **design**, it has widely been agreed upon that (architectural) design cannot be understood or learned solely through approaching it theoretically: it is a skill that can only truly be acquired through practising it (Grover et al., 2017; Till, 2017; Deutsch, 2020). One purpose of the design studio is to provide a learning environment where this practical approach can be executed (Grover et al., 2019; Lawson, 2019; Deutsch, 2020; Pelsmakers et al., 2021).

The design studio is a shared learning environment that typically represents both a physical space and a professional culture: tacit knowledge is transferred through concrete design activities and ideas are shared through conversation and reflection, ideally with peers yet typically with teachers (Pelsmakers et al., 2021). The design studio has taken many forms throughout its history, with e.g., the Beaux-Arts tradition combining part-time apprenticeships with discussions with teachers; the Bauhaus model introducing full-time studies in a physical design studio simulating architectural practices; and the current problem-based learning model simulating real-life design tasks in architectural practices (Grover et al., 2016; Pelsmakers et al., 2021).

The physical studio space typically plays a central role as a learning environment in which students ideally spend most of their studies working together with peers and instructors. In some cases, e.g., in Finnish architecture education, the physical studio space is "represented through formally scheduled learning events like lectures and workshops where students come together to acquire necessary information for completing their design project" (Nisonen, 2022). Whether the design studio is a physical or figurative learning environment, it is *the* environment in which students are most subjected to and that has the biggest impact on what kind of professional values, cultures and norms they internalise (Pelsmakers et al., 2021; Grover et al., 2018; Nisonen, 2022, O'dwyer et al., 2023).

Contemporary architecture education is widely considered to follow the principles of **problem-based learning** (PBL), where students acquire a body of knowledge through studying and solving "real-world-problems" (Barrows, 1996). In architecture education these are typically presented in the form of "design problems" (or briefs) and concrete design activities (Hmelo-Silver, 2004; Bridges, 2006). Initially, PBL was developed to tackle top-down hierarchies in education: instead of educators acting as gatekeepers of knowledge, students themselves would gain capability and agency to discover and evaluate knowledge. Hence PBL is based on combining individual and collective reflection with theoretical research, to inform decision-making. Additionally, feedback and reflection on the learning and problem-solving process are considered paramount (Drinan, 1991; Engel, 1991). The typical application of this theoretical framework in most design studios has, however, had an impact on the effectiveness of the pedagogy, which we now turn to (Bridges, 2006; Nisonen et al., n.a.).

The design studio originally emerged as an extension of the workplace, mimicking architectural practice, its work culture, and its apprenticeship model, with a focus on the "what" and "how" in architecture and architectural design (e.g., Maitland, 1991; Bridges, 2006; Lawson, 2019; Deutsch, 2020; Grover et al, 2018, 2019; Kelly, 2021; Pelsmakers et al., 2021). Architecture education has been, partially because of the studio model, notably mono-disciplinary throughout its history with limited external influence (Grover et al., 2017, 2018, 2019; Kelly, 2021): it is taught by architects to architects, using and transmitting its own established language and culture that has existed almost unchanged for decades. It differs from traditional higher education by being more pragmatic than theoretical, and is heavily characterised by the knowledge, interests, and experience of the individual practitioner-teachers (McDonnell, 2018; Grover et al., 2019; Pelsmakers et al., 2021; Nisonen 2022).

Alongside these characteristics the design studio provides a unique and exceptional learning environment (in a higher education setting) that fosters shared experiences and one-to-one interaction between learners and educators. However, it is a highly **exclusive** learning environment: professional practices are developed through intersubjective validation of architects and the architectural world. Moreover, the field of architecture education is fairly inaccessible from the outside, due to both a lack of connections to broader theoretical frameworks and a lack of interdisciplinary research (Till 2007 & 2017). It is mostly studied and developed by architects themselves (likely as a result of the Modernist / Bauhaus idea that design can only be learned through practicing it), and the connection to broader learning theory is (accidentally or deliberately) ignored.

Since the Bauhaus theories and the emergence of Schön's Reflective practitioner in 1984, limited effort has been made to introduce or widely adopt new theoretical approaches to the design studio: "reflection in action", "learning by doing" and the imitation of real-life design problems are still central to its pedagogy (Grover et

al., 2018; Pelsmakers et al., 2020; Pelsmakers et al., 2021). Building on the Bauhaus theories and the idea of Master-teachers, Schön portrays the learning process of design skills as mimicry or imitation of established practitioners (or their work) (Schön, 1991). Bauhaus theorists described the characteristics of such practitioners as following: "True creative work can be done only by one man whose knowledge and mastery of the physical laws of statics, dynamics, optics, acoustics equip him to give life and shape to his inner vision" (Gropius et al., 1975). In a master-apprentice culture, rather than communicating established theories or research, these **individual** practitioner-teachers **transmit** their personal tacit knowledge to learners though the demonstration of design activities (Grover, 2018; Pelsmakers et al., 2021). This demonstration has typically been done through one-to-one discussions with students, providing the learners personal attention that can be considered rare in a (contemporary) higher education setting.

The master-apprentice culture represents a long-established method for the transmission of skills (Grover et al., 2019; Pelsmakers et al., 2021; Kelly, 2021; Nisonen et al., n.a.), and it has traditionally been seen as both efficient and effective. The core logic behind it is, however, flawed from a contemporary educational perspective. In the original theory, drawing heavily from behaviourism, Schön gave little importance to **two-way dialogue** between the learner and the educator, but instead emphasised hierarchy and the role of the learner as someone to whom information was **transmitted** by a more experienced practitioner (Schön, 1991). As highlighted earlier, this transmissive approach does not encourage **critical reflection**, a skill paramount for observing, reflecting on, and renewing the present unsustainable practices, paramount in the climate emergency (e.g., Burns, 2011; Värri, 2018; Monroe et al., 2019; Cantell et al., 2020; UNESCO, 2020; Bryan, 2022).

Moreover, behaviouristic learning environments tend to create high hierarchies: the established practitioners are held to a higher value than the students, and this power position determines the nature of the teacher-student interactions, jeopardising genuine two-way communication and sharing of knowledge between teachers and students (Burns, 2019; Livingstone, 2020). In this system the teacher roles are "top-down" and heavily limited around subject expertise and gatekeeping of knowledge. This typically creates a learning atmosphere that prohibits low-hierarchies, open discussion, and critical questions. Individuals' expertise, certain types of knowledge and practice are legitimised over others, and the professional agenda of architecture education may be formed through personal perceptions instead of collective interest or agreement (Grover et al., 2019). Moreover, as noted earlier, hierarchical or oppressive systems tend to create systemic ignorance: when the views of an individual are highlighted, opposing views are likely downplayed or neglected in order to maintain the existing power positions. This also strengthens the exclusivity of a learning environment. (Burns, 2011; Brookfield, 2012; Grover et al., 2017, 2019). Holism and critical thinking require for versatile voices to be heard and acknowledged. Inclusive learning environments with low hierarchies also support a diverse body of students (Atekpe, 2022).

Research suggests that since the practitioner-teachers in the design studio often haven't undergone pedagogical training, they tend to lack the skills or the tools to communicate their expertise and tacit knowledge in an inclusive and approachable manner (Grover et al., 2019; Kelly, 2021; Salama, 2021; O'Dwyer et al., 2023.); many practitioner-teachers view the design process as something intuitive and personal that cannot be rationalised or openly communicated to the learner, nor easily assessed through objective criteria. Without pedagogical training there can also be a lack of self-reflection on how individual teachers' values and ideologies affect the methods they are employing in their teaching, and the learning cultures they promote (Salama, 2021). Design is typically

considered as self-expression or self-actualisation rather than facilitation of collective needs for the common good, and creativity as an individual trait or skill that is about the creation and manipulation of architectural form, rather than an ability to (collectively) define and investigate design problems or broader societal phenomena through spatial and functional viewpoints (Grover et al., 2018; Kelly, 2021; Tucker, 2021). Hence, in order to create sustainable learning cultures in the design studio, a more implicit focus on the pedagogical training or upskilling of the (practitioner-)teachers is paramount (O'Dwyer et al., 2023).

In architecture education, research has mainly focused on increasing the sustainability knowledge and competences of learners (Boarin et al., 2020; Boarin & Martinez-Molina, 2022; O'dwyer et al., 2023). Sustainability is, however, dependent on a holistic transformation of one's self-perception, belief systems, habits and feelings (e.g., Burns, 2009; Värri, 2018; Cantell et al., 2020; Blanco-Wells, 2021; Huttunen et al., 2021; Essomba et al., 2021; Bryan 2022). An individual cannot act truly sustainably in their professional or personal life unless their values, beliefs and behaviours are turned towards a sustainable transition, i.e., when they start to feel and believe that sustainability is something worth aspiring (Cantell et al., 2020). Research, particularly in environmental education (including e.g., education for sustainable development) and other closely related fields, suggests that this transition can be achieved through holistic and transformative learning where the learner is seen and heard as an individual, as well as a part of a broader community with collective responsibilities (e.g., Burns, 2011; Värri, 2018; Aedo et al., 2019; Boetto, 2019; Monroe et al., 2019; Rodríguez Aboytes & Barth, 2020; UNESCO, 2020; Cantell et al., 2020; Bosone et al., 2022; Bryan, 2022). The following section explores approaches for embedding these values and cultures into architecture education.

Dismantling barriers preventing holistic sustainable architecture education

This section brings together insights from previous sections that explored the broader societal origins of (un)sustainability, educational concepts related to the internalisation of values and cultures as well as the key learning environment of architecture education, the design studio. These insights are mirrored against best-practice examples drawn especially from the field of environmental education.

In order for architecture education to holistically sustainable it needs to actively transition away from its transmissive approaches to learning that negatively affect the development of professional values and cultures on multiple levels. While some elements of the master-apprentice culture are still relevant in a transformative pedagogy, a profound reimagination of how we work has to be borne out of completely different internal values and new design cultures.

Instead of exclusivity and individualism, designing for the climate emergency requires **inclusivity** and **collaboration** towards *shared* societal goals (e.g., Burns, 2008, 2011; Värri, 2018; Monroe et al., 2019; Boetto, 2019; Blanco-Wells, 2021; Sterling, 2021; Huttunen, 2021; Boarin & Martinez-Molina, 2022; Nisonen & Pelsmakers, 2022; Essomba et al., 2022). This should also be reflected in the learning cultures of the design studio; education should not be "done to" students as a transmission of skills and knowledge, but in reflective dialogue with them, building on the learners' strengths and experiences (Burns, 2011; Mezirow, 2012; Livingstone, 2020). In current educational research learning is seen as a constantly evolving, shared process where knowledge is actively constructed by the learner (Burns, 2011; Mezirow, 2012; Kolb, 2014). Moreover, this knowledge that is being constructed is multidimensional: instead of right solutions a spectrum of possibilities is opened (e.g., Värri, 2018; Cantell et al., 2020; Barrett et al., 2017).

To inspire students to act against the status quo and challenge themselves and their beliefs – as well as those of other people and systems – learning environments should foster **inclusivity, collaboration, dialogue,** and **low hierarchies** (e.g., Burns, 2011; Mezirow, 2012; Kolb, 2014; Chan & Sher, 2014; Aedo et al., 2019; Aboytes Rodríguez & Barth, 2020; Núñez-Andrés et al., 2022; Monroe et al., 2019; O'Dwyer et al., 2023). Critical thinking skills can only be formed when individuals are subjected to versatile voices and opinions, and through these encounters be able to build internal motivation for learning, reflect on their own ways of thinking and form their own values and meanings rather than act on those of others (e.g., Mezirow, 2012; Brookfield, 2012; Kolb, 2014).

Dialogue also supports diversity in a learning environment. Without dialogue or reflection, beliefs are justified through **tradition, authority or force**, and driven through extrinsic motivation (Brookfield, 2012; Kegan, 2018). This is why hierarchical and individualistic learning cultures are so harmful: when the capability of some individuals is highlighted, that of others is downplayed. The Capitalocene, and the long tradition of architecture educations entanglement in it has normalised these top-down power structures and the promotion of individual capabilities and needs over collective ones (Yusof & Kozlowski, 2015; McBrien, 2016; Moore, 2019; Tucker, 2021).

When architecture (education) highlights the mastery of individuals it also suggests that instead of a collective dialogue, architecture is a form of individualistic artistic representation and the expression of one's personal creativity (Grover et al., 2017; McLaughlan et al., 2021; Nisonen et al., n.a.). An architect is seen as someone who has the capability to rationally and logically interpret, diagnose and universalise others' needs without consulting the users themselves (Ward, 1991). This worldview stems from and aligns with Modernist ideals of individualism and positions the architect as someone that is superior to others.

Instead, we suggest that, rather than it being individual self-expression of art and form, creativity should be seen as a shared experience that motivates problem-posing as well as problem-solving for the greater good. This transformation starts with dismantling transmissive learning cultures in the design studio. Instead of being a result of exclusive one-to-one discussions between practitioner-teachers and learners, tacit knowledge should be passed on through shared dialogue, where everyone in a learning environment participates in collaborative knowledge creation (Chan & Sher, 2014; Grover et al., 2018; Deutsch, 2020; Boarin & Martinez-Molina, 2022). Moreover, to support learners' critical thinking skills, this shared dialogue should extend beyond the "classroom" to include versatile and even contradictory viewpoints from e.g., researchers and professionals from other fields, practitioners in architecture, as well as other potential users, communities and stakeholders (Sterling, 2013, 2021; Chan & Sher, 2014; Yusof & Kozlowski, 2015; Till, 2020; Tucker, 2021).

In this type of participatory or co-creative education the role of the teacher is to facilitate students' knowledge construction by introducing learners to a problem context and to help them broaden their understanding around it by providing supportive information, tools for exploration and personal motivation to identify and acquire more information. This can only happen when the role of the teacher extends beyond the high authority of subject-expertise (Kolb, 2014; Mezirow, 2018). Such methods are used broadly in place-based environmental education, including, for instance, teacher education (e.g., Alsop, Dippo, & Zandvliet, 2007; Reddy, 2021) and educational work with children and youth (e.g., Harrison, 2010; Littrel et al., 2020).

Architecture has a deep-rooted tendency to "other" non-architects (i.e., users and other stakeholders) and overlook their ability to express their true needs and aspirations (Mangold, 2010; Yusof & Kozlowski, 2015; Tucker, 2021). This tendency also heavily relies on a Modernist dichotomy of reason-emotion: professionals hold the *logical* capacity to understand others, and a need for empathy and emotional connection to the needs and experiences of users is secondary or unnecessary. Moreover, nature has been seen as something that doesn't need to have a voice in the first place; human needs and aspirations dictate the ways it will be managed. Instead of being treated as living beings with absolute value as well as a necessity for human life, ecosystems are typically seen as complex yet manageable entities that hold an instrumental value to serve human needs. (Ruder & Sanniti, 2019; Boetto, 2019; Fox & Alldred, 2020).

These narratives can be dismantled only with a deliberate focus on critically evaluating them and allowing for learners to encounter and reformulate the "why" in design. Instead of continuing the Modernist tradition of prioritising and improving the life, health and wellbeing of humans alone, the focus should shift to involving people as excentric beings with specific responsibility for their living environments, and to expanding understanding and caring relations towards all living creatures and the ecosystems they form. Such planetary wellbeing, where the intrinsic value of different organic creatures is acknowledged, is the condition for the wellbeing of all life (e.g., Plumwood, 1993; Burns, 2008; McBrien, 2016; Moore, 2017, 2019; Blanco-Wells, 2021).

Transmissive teaching through a mechanistic worldview largely determines the way the nature is approached in learning. Instead of seeing nature as a resource separate from humans, transformative learning approaches encourage a view of nature as a home, a web of interconnected and interdependent life with valuable biological and cultural diversity. They also acknowledge the role of personal growth and social change in sustainability. (Burns, 2009, 2011; Barrett et al. 2016; Aboytes-Rodríguez & Barth, 2020). To this can be added, drawing from the Plessnerian perspective of environmental relations, the "constitutive homelessness" that characterizes human existence (Plessner 2019, also van Oosten 2014). Unlike other species, we do not enter the world through an ecological niche, thus have to *create* a home for ourselves, which takes place through building culturally mediated environmental relations. Understanding this fundamental human condition would be helpful for developing sustainable architecture education. For learners to engage in active promotion of sustainability both in the work and their private life, education should have an implicit focus on their values and active agency (Burns, 2011; Wodika & Middleton, 2020). Dialogue and collaboration are a paramount part of this process, as human ability to collaborate, establish and maintain mutual relationships "determines their actions towards the environment" (Kondrad et al., 2021).

Conclusion

This research explored values and cultures that prevent holistic sustainability in architecture education, bringing together insights from various fields such as social sciences, learning theory, environmental education, political ecology, feminist theory and ecofeminism. Instead of an attribute of design, this paper suggests that sustainability should be seen as the *framework* within which architects operate and validate their actions: the starting point, the process, and the outcome of actions. We identified two key dichotomies that reflect broader societal origins of unsustainability and are also visible in architecture education: *exclusivity–inclusivity* and *individualism–collaboration.* These dichotomies seem to be at the heart of preventing holistically sustainable architecture education: they are intertwined with the design studio's purpose, values, pedagogy and approach to learning.

We first found that the Modernist principles of contemporary architecture (education) are deeply connected to the root causes of the climate emergency. The ideals of rationalism, logic and positivism justify the separation of humans and nature and validate the exploitation and oppression of nature and vulnerable communities for profit and the accumulation of capital. Educational systems also reflect these values. Modernist ideals promote a **mechanistic** worldview, where anything in the material world (e.g., nature, behaviour or thinking) is seen as something that can be understood and managed through logic and rational thinking, and that nature is something that can be exploited for human purposes. This worldview promotes **transmissive** approaches to learning, where knowledge is transmitted to students through one-way communication, and learning serves to keep a system stable by informing learners on how actions can be improved to reach a desired outcome. This approach turns learning environments highly exclusive and individualistic.

Instead, the critical literature we align with suggests that architecture education should transition towards a **holistic** worldview that does not separate humans from nature but, instead, highlights the interconnectedness and interdependence of all life while at the same time acknowledging human exceptionality in terms of duality (humans hold a greater responsibility in their actions towards the environment than other species), and promotes critical thinking, reflection, and responsible agency. This worldview promotes a **transformative** approach to learning, where knowledge is collectively created through dialogue and reflection, and where learning serves to transform a system instead of keeping it stable.

A deliberate transition in **worldviews** facilitates a transition away from problematic and unsustainable cultures in architecture education. In the design studio, hierarchical and exclusive cultures around the transmission of tacit knowledge should be actively dismantled and replaced with collaborative and inclusive approaches that promote mutual dialogue and critical thinking.

The need for further research was highlighted and includes building on the themes in this work and further testing it; an increased understanding of the worldviews of architects, architecture educators and students should also be conducted. Further research into teaching methods and pedagogical approaches that support this transition, and ways to implement them in the context of architecture education, is needed.

Further, the climate emergency calls for a systemic investigation of the design studio, where its purpose, values and pedagogy, and its approach(es) to learning are critically reflected upon. Moreover, educational institutions and teachers have a responsibility to understand the social (professional) culture the design studio transmits and supports, and to evaluate its effects on the learners. The lack of this reflection or the lack of action regarding these reflections fundamentally prevents the creation of sustainable architecture .

This research has provided insights on broader societal values and cultures that have validated unsustainable practices in architecture education, and proposed approaches to a(mend) them. Instead of solely focusing on teaching case studies, further (interdisciplinary) research on the topic of values and cultures in architecture education is paramount in order to rethink and reform architecture education in the climate emergency.

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