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Review

A New Retail Interior Design Education Paradigm for a Circular Economy

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Abstract: Since the advent of a circular economy, typical strategies for change have focused on circularising existing business models or developing new closed-loop ones, where design is understood as a service provider, adapting its processes accordingly. This understanding and application of design is problematical, constraining and misdirecting any potential for effective innovation in the future. Interior design methodology needs to be completely rethought to create a sustainable circular design ecosystem. The learning and teaching of the interior design process has its foundation in an unsustainable, traditional economy that operates in a closed linear sequence of design, specification and fit-out. An undergraduate retail interior design project highlighted the need to evaluate designing for a circular economy as an ecosystem, based on the 10 R's leading to four building blocks for the learning and teaching of circular retail interior design. Through analysis of the nature and existing use of design within a circular economy, it is possible to conceptualise the deconstruction of the existing linear process of interior design pedagogy and rebuild that process as a sustainable circular retail interior design methodology. This paper identifies four key sustainable design principles as a foundation for a new education paradigm for a circular interior design ecosystem model.

Keywords: restorative; ecosystem; interior design; waste; innovation; collaboration; value chain; circular economy

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1. Introduction

Given the complex nature of business operations that make up the linear economy and the concept of the circular economy itself, it is not surprising that confusion exists around its understanding. How this can negatively impact design is continually demonstrated when design student cohorts have been introduced to the circular economy concept in relation to retail interior design projects.

The circular model considers the economy to be both restorative and regenerative. It proposes concepts such as repeated resource utilisation, reduction of waste (biological and technical), circular value chains, and creation of an ecosystem collaborating with partners, which in turn provide for the generation of economic, environmental and social capital. The circular economy model hinges on developing innovative ways of consuming, extending and reusing materials and products through the process of designing and the design economy. Subsequently, "The intrinsic value of components is not lost in the consumption process, but a premeditated effort is made to retain and grow value" [1].

There are two key problems at play here. The first relates to the development of a circular economy that places 'business' as the driving force with 'design' as a secondary or reactive player. The second is a narrow understanding of the role and capability of design in maximising innovative, successful and highly effective circular economy models for the

future. Business is at fault as it perpetuates an economic value system designed to write down and write off waste material and products deemed outdated due to a perceived economic timeline rather than actual deterioration. Design is equally at fault here in perpetuating a reactive role for the needs of business growth and profit by constantly updating or customising the design of products, artefacts and the built environment for ever-increasing consumption and productivity.

The findings from this paper demonstrate that much of the research into sustainable design is flawed to some degree due to the catch-all use of the term design. There are many different categories of design; this is the real problem in that much research is actually based upon the design of a product and assumes all other design fields or categories have been equally addressed.

A great deal of research on sustainability and a circular economy already exists within the areas of product design and fashion design. However, in the case of interior design for construction and fit-out of the built environment, which for the purpose of this research includes built-in furniture, fixtures, fittings and equipment (FF&E) but excludes loose furniture or products, there is very little beyond the sustainable use of services for lighting, heating, air conditioning and so forth. According to Leising et al., the building sector focuses on issues around energy efficiency, where the circular economy is still a relatively new topic [2].

In operating as a part of the existing built retail environment, interior design fails to recognise both how it creates waste and the powerful position it occupies in providing influence within the construction and design industry to minimise waste. An opportunity, therefore, exists to incorporate and implement a circular ideology as an 'ecosystem' to form the basis of a future innovative retail development business model.

This paper proposes that a new interior design paradigm could catalyse a sustainable, circular ecosystem of allied businesses within any existing or future retail development. By moving from being a reactive service provider to a proactive leader, interior design is primed to provide an innovative circular framework for a sustainable design ecosystem of compatible and collaborative actors. In the process, interior design professionals would become key participants in creating and implementing a circular economic model for new, future and existing built retail development.

This is preliminary investigative research into the existing understanding, nature and use of design within a circular economy. This is a critical aspect, given the term design suggests the process of designing is the same across all design fields. However, this is not the case. There are many similarities, but equally, there are also critical and important differences when designing for a product or artefact as opposed to designing for built retail environment construction and fit-out.

This research examines the current use of design, how it is understood within a circular economy model, and how this pertains to the built retail environment, including the added value created and captured through a circular interior design methodology. The intention is to identify foundational design principles necessary for a circular ecosystem to form an educational basis for a sustainable retail design, development and construction industry. To achieve this, we first need to identify the current design practices that exist within a circular economy model.

2. Materials and Methods

The preliminary literature review highlighted how much of the past and current research has been written from the perspective of product design and does not really consider the perspective of interior design for the construction and fit-out of the built retail environment. The hypothesis is that through analysis of the nature and existing use of design within a circular economy, it is possible to conceptualise the deconstruction of the existing linear process of interior design learning and teaching pedagogy and then rebuild that process as a sustainable circular retail interior design methodology. Thus, this investigation is mixed methods research using mainly qualitative research for textural

analysis of how design is understood, how it is used and how it is applied within the context of current circular economy thinking and modelling. In this way, the circular economy and ecosystem gaps related to interior design for the construction and fit-out of the built retail environment can now be identified to provide new information.

Quantitative research has been used to create a preliminary snapshot of students' circular economy understanding within 13 work-integrated learning (WIL) retail design projects. This provided some initial insight in terms of existing gaps within the learning and teaching of interior design towards the development of four key design building blocks identified toward the end of the research paper. (1) Waste minimisation or the ten R's and (2) Ecovalue, in terms of a range of values, are the first two building blocks, and these identify the area in which the gaps lay. Whilst neither of these preliminary learning and teaching blocks are novel within themselves, novelty exists in how they have been developed, their relationship and their use within the context of future interior design learning and teaching. In addition, they also provide a new and novel template to progressively address each gap through the future built retail environment development and research.

The relationship between waste minimisation and ecovalue has been further enhanced through the development of a rubric to assess the exact nature of waste minimisation within any built retail environment, either new or existing, and the value retention opportunities under ecovalue that exist within.

2.1. Part 1: The Current Role of Design in a Circular Economy

2.1.1. What Is Circularity in the Context of DESIGN?

A circular economy operates on three main principles to eliminate waste and pollution and maintain the circulation of products and materials to ensure the highest utility or value whilst allowing the regeneration of nature. This is in sharp contrast to a linear economy which operates on a 'take, make, waste' paradigm [3].

Much of the existing research revolves around value retention by extending the life and use of products and materials. The value retention action areas tend to focus on biodiversity, cities, climate, fashion, finance, food and plastics, where the "circularity" within a circular economy is referred to as the three 'R's of reuse, regenerate and recycle.

According to Kirchherr et al. (2017), in a review of various disciplinary backgrounds, which included environmental sciences, engineering, logistics, policy studies and others, a messy cacophony of the use of R's as value retention imperatives existed and the misuse of the word "recycling" as an overarching concept was a particular problem [4]. Similar uncertainty is identified within policy documents from both the UN and EU, which suggests a more serious issue around meaning and interpretation within the scientific literature [5].

Reike et al. [6] provide a reference guide to what the authors see as the ten key value retention options:

R0 Refuse—For the consumer, it is a case of buying less and using less. For the producer, it is extending the life cycle through the design of the product to avoid waste and the use of any hazardous materials.

R1 Reduce—This is a generic term where the focus is on the elimination of the production of waste, as opposed to its disposal.

R2 Resell/Reuse—This is the two sides of the market transaction necessary to ensure products stay in the economy after the initial purchase and use.

R3 Repair—To bring back to working order; however, it tends to be confused with 'refurbishment'.

R4 Refurbish—Understood to be an overall 'upgrade', especially where components are replaced or repaired.

R5 Remanufacture—Described as reconditioning, reprocessing or restoration; however, unlike refurbishing, the quality or lifespan is seen as reduced when compared to a new product, in part due to the component(s) being recycled.

R6 Repurpose—Reflects artistic or industrial design areas where something is partially reused or refashioned in some respect that is different to its original purpose, where discarded products or components are adapted for a different function, such as a sculpture or cannibalised machinery from one product to create or repair another.

R7 Recycle Materials—The recovery of existing materials to avoid the use of 'virgin' materials or finite resources.

R8 Recover—This has three interpretations, (1) collecting used products/materials at their end-of-life, (2) extracting elements or materials from end-of-life composites and (3) the capture or production of energy within waste material—for example, incineration to create heat.

R9 Re-mine—The retrieval of materials after the landfilling phase.

2.1.2. The Argument for Design Circularity as a Template for Circular Economy

In conceptualising the circular economy, Kirchherr et al. (2017) describe an economic system that attempts to replace the 'end-of-life' linear business model.

Their findings go on to highlight three key barriers:

(1) Business ignores the necessity of creating a systemic shift to create a truly effective circular economy model.
(2) How economic prosperity comes first, followed by environmental quality, is then compounded by the fact that any impact on social equity and future generations is not really considered.
(3) Neither business models nor consumers are seen as enablers of the circular economy [4].

According to Opferkuch et al. (2021), corporate sustainability reporting could address these barriers and allow stakeholders to make reliable evaluations of non-financial performance, including the social and environmental aspects of businesses within a circular economy. The authors draw attention to other benefits, including credibility, reduced legal risks, improved supplier relationships, increased access to capital and ethical behaviour along the supply chain [7]. However, the authors also highlight the need for guiding principles and procedures before corporate sustainability reporting can be introduced. A circular design ecosystem would provide guiding principles and become the enabler to assist the business in creating a truly effective economic model, where the focus is first and foremost on social equity and reducing the environmental impact for future generations.

This includes rethinking the way business creates and delivers value within a closed-loop system. There is a clear need to redefine value in relation to the ten 'R's within a circular economy, to go back to the basics of Marx and revisit the nature of use-value and exchange-value and introduce eco-value. The circular economy is both restorative and regenerative, where the intention imperative is to maintain or upscale value in each step. Subsequently, innovation, as the very essence of design thinking, is a primary requirement to arrive at the optimal intersection between sustainability and profitability [8].

In the take, make, and waste approach, value chains create value based on the production of goods and services [3], where value is simply viewed as an economic equation. This is a limited or very narrow view of what value really is or should be and thus tends to horde value rather than fully utilise it.

Innovation through a design thinking methodology for design circularity can form the basis for increased value, not just from more efficient material use and reuse, but a new understanding of what value is and designing material use for real need. This was backed by research which arrived at the conclusion that larger bedrooms in larger homes had a higher material intensity than smaller ones [9].

Replacing traditional concrete beams with recycled 3D-printed plastic beams based on Lego bricks is an example of innovative design looking at addressing sustainability issues in the built environment. Using technology to create components made of recycled plastic is an ingenious way of embedding value. These Lego-style bricks, designed by researchers from the Polytechnic University of Valencia, are 80% lighter than traditional beams and

require less concrete. It also makes the process of building easier, and uses less energy and time [10].

In *Barriers to circular business model innovation,* the authors describe the need to change existing models in a mature company, craft entirely new business models as 'start-ups,' or develop a new business area within a mature company. [11].

A circular design ecosystem would provide the basis to identify new enterprise opportunities, partnership networks and necessary areas of change for sustainable businesses. To create a harmonious and sustainable interaction between the economy, society, and the environment in which economic activity strengthens the social and environmental systems they exist within [12]. As an operational strategy, circularity hinges on the creation of new ways of producing, transporting, consuming, and reusing materials, components, and products [13–16].

Relationships generated in partnership networks create the foundation for sustainable ecosystems. As materials/components pass through a circular value chain within the ecosystem, they are seen as resources to be used repeatedly instead of simply being wasted [17]. The efficient resource use and customisation of products and services further refine the offering to customers, reducing the unfettered use of scarce resources and diminishing the environmental footprint [8].

A key finding of recent research conducted across a variety of industries in the US suggests companies that successfully integrate sustainability and subsequent strategies into their business models are more profitable in the longer term [18]. The benefits are greater for companies with comprehensive, transparent procedures and systems, long-term goals, reporting on both financial and non-financial measures and competing on brand /reputation [15].

Circular business models could be described as 'paying value forward in a loop or designed ecosystem', which collectively demands and fosters a mindset of 'growing value'. This requires businesses to create circular supply chains or networks that recover or recycle the resources used to create products [19]. In doing so, the seemingly disparate construction arenas can reassess where waste is most prevalent within their value chains and how this loss can be stemmed through innovative loops within a circular design ecosystem. More efficient utilisation of resources allows for slowing, narrowing, and closing the loop, which further aids businesses in shrinking their environmental footprint [13].

In the circular process, the value capture loop using recycling is the least efficient use of resources, whereas simply using less or refurbishment, secondary life uses, parts harvesting, and increased utilisation show significantly more gains. A circular design ecosystem would aim to incorporate not just the value to the individual business but also incorporate the value generated for society and the environment where the performance of a business is measured in terms of a triple bottom line to include people, profit and planet [20].

To this end, [21] suggests that in the circular economy, the three spheres, economic, environmental, and social performance, are systemically intertwined and continuously and cumulatively affect one another through mutual causality and positive feedback. A key issue here is that most products or environments have never been designed or built for circularity, nor were their operations developed to support a circular model to retrieve the economic value. If we temporarily posit this into the arena of retail design and development, we can identify two scenarios that would need to be considered: (1) how we deal with the existing built retail environment and (2) how we deal with any future built retail environment to ensure and maximise value retention within a sustainable circularity model or ecosystem.

The first scenario suggests a designed approach to any future demolition as a methodical process of deconstruction to reclaim, catalogue (as intelligent assets) and maximise the reuse of construction materials, fixtures and fittings and minimise any potential waste. The second is designing the construction of any future built retail environment as a complete circular ecosystem that deliberately provides for ease of future material/product harvest-

ing, reclaiming and reuse. Re-establishing retail development and construction businesses with economically sustainable circularity as a main driving principle, based upon an interior design ecosystem methodology that includes a life cycle assessment process. These businesses would have a culture of sustainable circularity from the outset, attracting and collaborating with like-minded partners that share the same ethos.

Mostashari-Rad et al. describe Life Cycle Assessment (LCA) as an integral tool for evaluating the environmental burdens of product supply chains as well as comparing different options to determine the optimal option [22]. This is a cradle-to-grave approach already well-known in the field of product design. Nabavi-Pelesaraei et al. extend this understanding of LCA to include activities, processes, or products in the entire life cycle for designing in an ecological way [23], and this would be extremely relevant where fit-out materials, fixtures, fittings and equipment require contamination removal and cleaning due to glueing, nailing or other fixing methods used originally during earlier construction or installation.

Ref. [1] suggest three generic business strategies for economically sustainable circularity:

RPO—Retain product ownership—The classic version of a circular business model wherein the producers rent or lease a product instead of selling it. The ownership and responsibility remain with the manufacturer.

PLE—Product life extension—Design products to last longer, thus, preserving value in energy, labour and material used. This strategy can also provide access to the used products market, where products require refurbishment.

DFR—Design for recycling/upcycling—A precursor to 'Reuse and Recycle 'is to preserve any embedded economic value so it far outweighs the costs associated with recovery and processing of the materials at the end of use'. The emphasis on retaining the high intrinsic value of materials, components, and products can literally be built-in right from inception through design. The collaborative ecosystem thus formed can further find innovative means of material and resource utilisation [1].

For example, new ships in the Danish company Maersk are designed so that they can be easily disassembled even after several decades, solving the problem of illegal shipbreaking causing pollution and health risks. This strategy enables the recovery of ship parts of high value while allowing for the simple replacement of parts that can give the ship a longer product life [8].

Whilst these business strategies go a long way in addressing the move toward circularity, they also highlight another critical issue when we consider them within the context of a built retail environment. Products, including ships, tend to be manufactured within a highly controlled static environment, such as a bespoke factory or ship-building yard that enables them to capture value. In contrast to this, retail development sites or at least the construction services and processes necessary at the time, tend to be nomadic, coming together for a time and continually making adjustments on the run, subject to different site needs. Thus, by its very nature, much of the current built environment fit-out process is not conducive to minimising waste or capturing value. This limits or constrains the opportunity for effective circularity.

There are two potential strategies here: (1) rethinking the retail built environment fit-out and de-fit to be completely carried out within a controlled factory environment, with on-site installation as minimal assembly, as a ready-to-operate environment. (2) Treat retail built environment sites as temporary factories with (nomadic) sustainable services to maximise control and ensure minimal waste.

Complementary literature on sustainable circular business models highlights the need to understand how to 'capture value' that incorporates the benefits to society and the environment [24].

Adner (2017) postulates that the circular ecosystem considers the business model of all the actors in the value chain to be important [25]. As a business strategy, the actors in a circular ecosystem collaborate and join complementary skills and capacities. They create and capture value by finding innovative solutions, closing the loop and increasing

their survival capability in a turbulent market [26]. This collaborative network generates conditions of trust and learning through the sharing of knowledge.

We can summarise this process of building social capital to close the loop predominantly by:

1. Aligning social values—Related to the behaviour of members, such as trust, solidarity, reciprocity, values systems alignment, rules and norms of governance
2. Leveraging and sharing of resources—Related to the number and type of resources that can be mobilised through the network, such as capital, raw-material, workforce, energy, goods and services
3. Sharing of knowledge and technology—Knowledge and expertise that can be made available through networks, such as skill, market and lobbying information

Ironically, the literature also highlights the complexity of quantifying social capital and value generated within a circular ecosystem. This is because the concept of social capital is very broad in its focus, and the value generated within relationships is not easily measured. Figure 1 provides a new visual model in terms of building social capital through the interior design process for new and existing built retail environments and the various potential relationships and opportunities. It shows the relationships between value, systems and innovation in the interior design methodology.

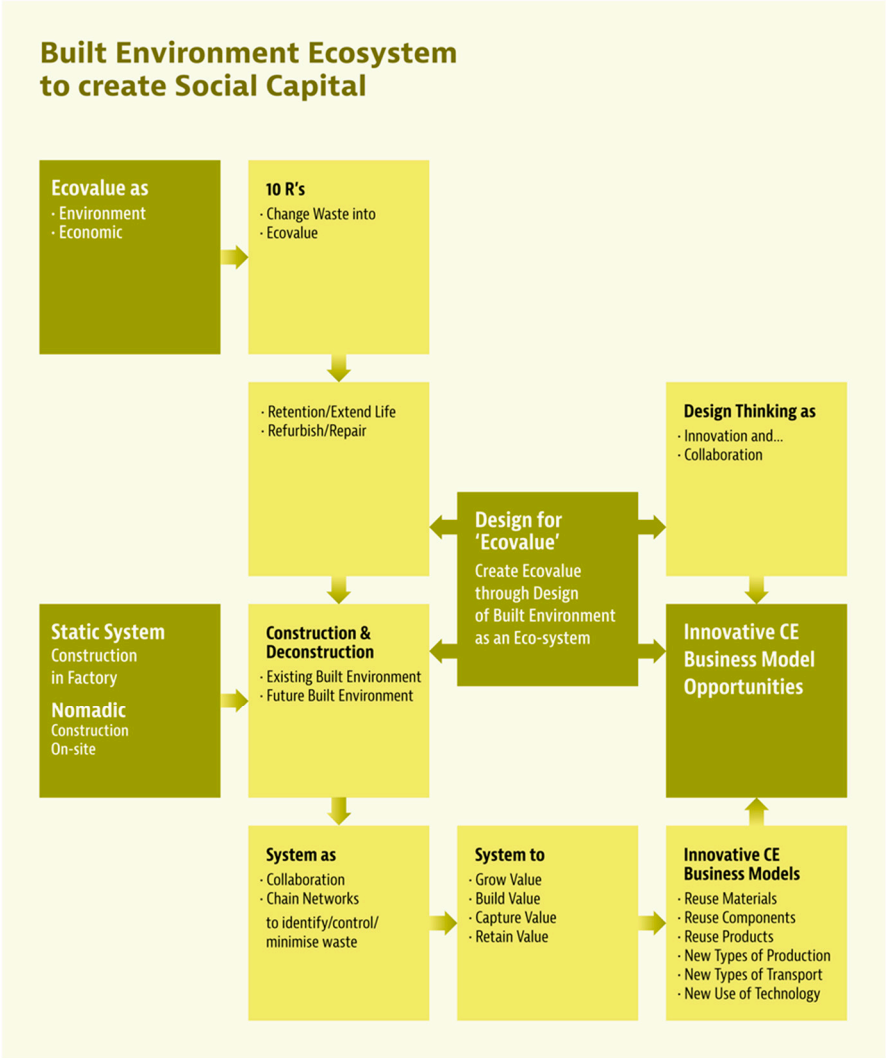

Figure 1. The diagram presents the relationship of key issues identified thus far in this study of the circular economy in terms of design methodology as value, systems and innovation.

Value:

- The key value retention options or 10 'R's.
- The need to redefine value or define eco-value.
- Value retention by extending the life of the material/built environment.
- Growing value collectively, a system of collaboration.
- How to capture value.
- Building value through aligning social values, leveraging and sharing resources, sharing knowledge and technology.
- Over-emphasis and misunderstanding of 'recycling'- least efficient in terms of value.
- Refurbishment; secondary life has more potential value.
- Design for real need/social value.

System:

- Three spheres: economic, environmental, and social performance, are systemically intertwined.
- Existing retail built environment system as methodical deconstruction to reclaim materials.
- Future retail built environment system as a complete circular ecosystem.
- Create circular supply chain networks that recover or 'recycle' resources.
- Identify where waste is most prevalent.
- Retail construction/development as a controlled static or nomadic environment system.

Innovation:

- Innovation and collaboration are the very essence of design thinking.
- Identify innovative business model opportunities, RPO, PLE, and DFR.
- Identify innovative ways of producing, transporting, and reusing materials, components and products.
- Innovative use of technology.

2.2. Part 2: Creating an Educational Model for Retail Interior Design Ecosystem

2.2.1. What Is Circularity in the Context of Retail Interior Design?

Interior design, as the built retail environment fit-out in terms of shopping centre development, is a massive design and construction industry worldwide. Based on the author's 40 years of retail fit-out experience, operators generally demand a five-year period for retail updates in order to maintain customer traffic by ensuring freshly evolving environments as regular destination points. In addition, there is site redevelopment, expansion and upgrades to existing shopping centres, as well as the development of new sites through competition. It is not difficult to appreciate the negative impact of ever-increasing construction on our natural environment in relation to the use of virgin materials and the generation of volumes of construction waste. Equally, this also highlights an opportunity to reverse this through a design methodology that re-values materials and waste as ongoing assets.

The value created through the design and development of a successful retail environment is clearly underlined, with all retail developers/operators providing extremely detailed design and fit-out guidelines for prospective retail outlets. However, in terms of sustainability and circularity, the majority only focus on the use of energy and water and, in particular, low-energy fittings to minimise greenhouse emissions. The use of recycled material tends to be bent or limited to reclaimed products remanufactured into flooring, cladding, or used as a decorative feature. We cannot simply bend a linear process, as described by Tim Brown from IDEO, into a circular process. This is well-intentioned but somewhat misleading, even as a simplistic descriptive theory [27].

Our research identified fit-out guidelines specifying in much more detail what retail designers could and could not do, including selecting shopfitters who could demonstrate a proven record in environmental practices [28].

Product design utilises effective circular design principles, for example, that of 'Eco-feedback', which according to Wever et al. (2010), explicitly communicates to the product

user how his or her behaviour will impact the environment. They introduce a second option of 'scripting', which designs a product in such a way that the desired behaviour is made easy and the undesired behaviour is made difficult [29]. If we consider this in relation to products as construction materials or finishes for design, these are, in general, materials that have to be continually trimmed and adjusted on-site subject to each project. On the face of it, they do not appear to lend themselves efficiently or effectively to either of the suggested forms of eco-feedback. However, from an educational view, eco-feedback as designed behaviour influence or direction does demand further investigation. The issue of bonding agents, glues and sealants and/or fixing products such as nails and screws could also be considered as they are part of the design and construction of a built retail environment.

A static or nomadic environment circularity strategy identified earlier could create an opportunity for some form of eco-feedback to control and minimise waste and consider re-inventing more outdated yet traditional techniques of material bonding or joining, such as glue-less Mortice & Tenon or Doweling joints. In addition, this could provide for the potential of future customisation, refurbishment, remanufacture and so on, which in turn suggests a more modular approach to environment design and construction in the future. Whilst these possibilities are not meant to be solutions, they provide a more circular ecosystem thought culture if considered alongside concepts such as intelligent assets within the deconstruction of existing built retail development or future design development. They begin to provide a skeletal template for a circular design ecosystem and methodology educational model.

The Ellen MacArthur Foundation (2016) introduced the concept of intelligent assets in construction, pointing out that assets in the built environment go beyond improving energy efficiency. We are asked to imagine a world where all roads, bridges, public spaces, sports facilities, office buildings and private homes represent the biggest valuable material deposit for the built environment. In this world, these assets are connected to a digital library, revealing the up-to-date condition of the assets' components to enable predictive maintenance and performance models and be a platform for a secondary materials market [17].

For this to become a reality within the area of new and/or existing retail development through refurbishment, retrofitting, demolition and new construction, there is a clear argument that design education with respect to the role of the interior designer and architect is best placed to create a culture for this data to be gathered during the site survey and design process. This could be embodied in a library database shared with the industry that continuously develops using modern technology as each project evolves as part of an interior design ecosystem.

2.2.2. The Argument for Retail Interior Design Circularity Learning and Teaching as a New Paradigm

We have seen how retail interior design is a significant driver with influence over the use-value and exchange-value through the specification of constructional materials, installation finishes, equipment, furniture, fixtures and fittings and so on if these are viewed as products or commodities in one sense or another.

In *Capital*, Marx (1887) describes use-value as that of a commodity that has been created from a base material of some kind, suggesting the value is not only within the labour necessary to extract the commodity but the design process that, in turn, creates a product or commodity. Marx also described the design process of the base material as the fetishism of commodities beyond use-value, such as fashion or branding, to satisfy our metaphysical reactions or irrational desires, wants and needs [30,31]. The base material may have a variable value at any given point in time, but again this probably has more to do with supply and demand rather than the cost of the labour necessary to extract it. The fact that a base material, resource or commodity may be finite as opposed to being rare (e.g., gold) was never really considered by Marx in expressions of value, use-value or exchange-value. In the context of finite resources, eco-value has to be included in the circular economy equation.

Whilst retail interior design as a profession is not strictly speaking an economy in itself, linear or circular, it needs to interact with many other professions, trades, manufacturers and clients to participate in the linear economy. This highlights the powerful potential for influence that resides within the creative industry and, in particular, the profession of retail interior design through this interaction. Within the linear economy, retail interior design and the education thereof is a 'service' profession reacting to the desires, wants and needs of others, including retailers, developers and the construction industry. The future role of design is to create sustainable or circular outcomes that best address the needs of the end-user whilst ensuring minimal or zero impact on the global environment. Can retail developers and construction companies be considered the end-users of retail developments? Or could it be argued that the wrong needs are being met in the first place? Identifying a real need is one of the basic principles in the design thinking methodology. Educating proactive and innovative design students to assist businesses in developing and changing in the future would also convince stakeholders to embrace design innovation and leadership.

This highlights the opportunity for the retail interior design educational paradigm to move from that of a reactive service industry provider that addresses the demands of others to that of a proactive industry leader. It can be the catalyst in creating a circular ecosystem of retail design, fabrication and construction and questioning the need for constant de-fit of retail space.

The Circularity Gap Report (2021) argues it is necessary to adopt a systemic perspective during the design process to employ the right materials for an appropriate lifetime and extended future use [32]. It becomes apparent from this report that design is understood in much literature about the circular economy as a reactive 'service' vehicle. However, to move away from the traditional linear economy model of take-make-dispose and achieve a more restorative and regenerative circular process, design needs to be seen and understood as a proactive creator, instigator and developer of innovation.

In *Cradle to Cradle* (2002), the authors argue that without a systemic change in the way that we design products, services, systems and infrastructure, the potential of a circular economy will never be achieved. They also point out that design for a circular economy has to consider different design strategies for closed-loop systems as a pivotal point for its success. They recognised two cycles in which resource loops flow, the "technical cycle" and the "biological cycle" [33].

The biological cycle refers to products for consumption and includes items that are made of biodegradable materials that are effectively consumed during their life cycle and/or designed in such a way as to return to the natural environment without contamination. As an example, timber would be one obvious choice in relation to construction. However, the use of timber also raises many other considerations once it has been sourced. Has contamination occurred during manufacture and/or installation, such as preservative treatments, bonding or fixing agents? Contamination on one level would impact biodegradation; however, on another level, a preservative would benefit from reuse and could potentially move the product into the technical cycle.

Zelazinski et al. argue that raw materials for production could include biocomposites which fit the concept of sustainable development, being made exclusively from ingredients of natural origin based on natural fibres from renewable sources [34]. The majority of materials for built environment construction fall into production processes in one form or another, and by default, suitable biocomposites need to be considered part of the biological cycle. The journal of *Science and Engineering of Composite Materials* [35] comprehensively reviews biocomposite material applications. However, the authors also argue the need to rectify the potential value in creating new applications and in this respect, biocomposites could also become part of the technical cycle through the design of the retail built environments.

The technical cycle refers to products for service, and this is arguably the more important area for consideration by design in terms of construction and fabrication. In most cases, the design ought to look to existing sustainable biological materials and bonding agents

and focus on the design of new, or renewed, construction methodologies to maximise the reuse of materials when the need for deconstruction occurs.

Much of what has been written on the role of design within the circular economy tends to reside in the area of product design as fixtures, fittings and furniture. We have already identified there are distinct differences inherent in product design and its manufacture, as opposed to the design of built retail development and construction of environments. In contrast, the built retail development, even in terms of branded environments, is often bespoke or a "one-off" from one location to another using standard size materials customised on-site. Design thinking methodology and education models could be developed towards a new interior design paradigm as a circular design strategy to deal with all of the above.

A Conceptual Framework for Circular Design (Moreno et al., 2016) identifies five design strategies:

- Design for circular supplies: This strategy focuses mainly on the biological cycles and is not directly relevant to retail interior design.
- Design for resource conservation: This strategy focuses on products designed with the minimum of resources and is directly relevant.
- Design for multiple cycles: This strategy focuses on the longer circulation of materials and resources in multiple cycles and is directly relevant.
- Design for long-life use of products: This strategy focuses on extending life, offering services for reuse, repair, maintenance and upgrade, or enhancing longer-lasting relationships between products and users through "emotional durable design". This is directly relevant.
- Design for systems change: This strategy covers the whole spectrum of value creation for both biological and technical cycles and refers to design thinking in complex systems as a whole, and between parts, to target problems and find innovation [36]

This, in many ways, could be seen as the foundation of a new retail interior design education paradigm.

In addition, the authors provide a further set of 10 points to consider when designing for a circular economy:

(1) Design for "systems change."
(2) Design by identifying the new circular business model.
(3) Design by thinking of revolutionising the world.
(4) Design for multiple cycles (short and/or long), not only end-of-life.
(5) Design by thinking living and adaptive systems.
(6) Design with different participants within the value chain.
(7) Design by considering value in a broader view as an asset.
(8) Design with failure in mind: Test and prototype often.
(9) Design knowing where material/parts originate and go to.
(10) Design with "hands on" experiences that foster a call for action [36].

These suggested circular design strategies are not dissimilar from the key issues summarised earlier and provide a preliminary design education foundational direction. However, two underlying principles that devalue or undermine this sort of thinking are identified below but would be addressed within a new design educational paradigm for a retail interior design ecosystem.

(1) The starting point and driver tends to be the 'business model,' which we have seen has a very limited understanding of the capability of design (thinking).
(2) The focus is clearly on product design and a service industry business model, which we have demonstrated does not align with retail interior design, development and construction.

3. Results

This research has developed a rubric based on the ten key value retention options from the reference guide by Reike et al. [6]. These value retention descriptions within the rubric provide definitions more closely aligned to interior design and architecture, particularly to

the design and construction of a built retail environment. Each value retention option has further been divided into a new retail build and an existing retail build to identify where any differences may exist regarding assessment for value retention and application.

Given the nature of the built retail environment in relation to the typical design and construct methodology and process, the space needs to be further defined beyond its form and structure. In this regard, value retention has been further divided into three distinct elements. Environment, as a suitable term, reflects the overall function of any retail space. Fixtures, Fittings & Equipment (FF&E) to identify built-in products and furniture that form part of the design and construction package. Materials to identify both structural framework and surface finish materials. Free-standing or loose furniture items or products have not been included in this value retention assessment rubric.

Using an overall heading ecovalue, a range of value options have been further defined in relation to retail interior design within this research. These value options have been developed to assist in unravelling the nature of any potential value retention opportunities for the designer to optimise waste minimisation in the design process. In this new retail interior design educational paradigm, value retention, in one form or another, now becomes part of a critical design process. This rubric (Table 1) provides the designer with the means to analyse and assess value retention to enable a deeper understanding of that value contained within each of the ten 'R's.

To reduce the potential for confusion or conflicting design and construction situations, this research has defined how specific situation needs to be interpreted. For example, the refurbishment will only apply to an existing built retail environment. While it could be argued that the process of refurbishment technically becomes a new build to some degree, essentially, it is, first and foremost, a refurbishment at the outset and remains as this. On this basis, any new build is understood for the purpose of this research as *completely* new. That is, nothing existed prior to the new build. This would include a situation where an old building or other construction has been demolished to make way for the new building. This is not seen or understood as a refurbishment but a new build; therefore, refurbishment does not apply. However, a new build should be designed for future refurbishment as part of the design for deconstruction or disassembly. In that context, social, capture, build and define value would be relevant.

Use value—Relates to the value of use and need at any point in time. Is a product or material still useful? Can it be used or reused in some way?

Social value—Relates to the value of a built retail environment to society as a usable space made up of useable products and materials and a basic need to ensure waste minimisation at all levels, at any point in time, to benefit the planet.

Capture value—Relates to designing for future deconstruction or ease of disassembly of a built retail environment to ensure a continued product and material lifecycle of regeneration, where part of the design process is to capture value for both now and in the future.

Grow value—Relates to designing for added value or repurposing to increase real need and, in turn, develop or grow lifecycle regeneration value through the design process for a newly built retail environment.

Build value—Relates specifically to any newly built retail environment where the design includes mainly reclaimed materials and products as required, and the use of new or virgin materials and products is minimal.

Retain value—Relates to existing built retail environments and where the design uses what already exists for any proposed refurbishment or change of use.

Exchange value—Relates to an existing retail environment where materials and products are exchanged or sold onward to be used elsewhere to maximise lifecycle regeneration. This could include the development of a value chain.

Define value—Relates to demonstrating through design and documentation where any value exists.

Table 1. The rubric above provides an assessment tool for the interior designer or architect to determine the nature of waste minimisation within any built retail environment project and the potential opportunities for value retention.

Retail Interior Design Value Retention Assessment Rubric				
Waste Minimisation	**Description**	**Environment**	**FF & E**	**Materials**
		Ecovalue	Ecovalue	Ecovalue
R0 REFUSE *New Retail Build*	Early stage engagement can identify opportunities to 'refuse' a new build. This can be achieved through review of existing premises/portfolio for existing use/update opportunities. The Designer can also 'refuse' by interrogating the original client brief and recommending alternative approaches to use less to prevent use of raw or hazardous materials.	• Social Value • Build Value • Define Value	• Social Value • Build Value • Define Value	• Social Value • Build Value • Define Value
R0 REFUSE Existing Retail Build	The Designer can *'refuse'* by interrogating the original client brief and recommending alternative approaches to use less and prevent raw materials' use. The secondary focus is extending the life cycle through the redesign of the environment and reuse of fixtures & fittings and materials where viable or possible to avoid waste and use of any hazardous materials	• Social Value • Capture Value • Retain Value • Exchange Value	• Social Value • Capture Value • Retain Value • Exchange Value	• Social Value • Capture Value • Retain Value • Exchange Value
R1 REDUCE *New Retail Build*	The main focus here is to decrease the need for and use of raw materials. The secondary focus would be elimination of production of waste through the design process and during on-site construction phase. Designers should write the fitout brief to include a 'no substitutions' clause as such changes can lead to items being not fit for purpose. Condition maintenance through coordination of logistics and reverse logistics is also critical to ensure no damage to fitout items that would result in waste.	• Social Value • Build Value • Define Value	• Social Value • Build Value • Define Value	• Social Value • Build Value • Define Value
R1 REDUCE Existing Retail Build	The main focus here is to decrease the need for and use of raw materials. Existing built environments would require careful and considered de-construction with a focus on reuse and recovery of all possible materials, fixtures and fittings to decrease or eliminate raw material use. Designers should write the fitout brief to include a 'no substitutions' clause as such changes can lead to items being not fit for purpose. Condition maintenance through coordination of logistics and reverse logistics is also critical to ensure no damage to fitout items that would result in waste.	• Social Value • Capture Value • Retain Value • Exchange Value • Build Value • Define Value	• Social Value • Capture Value • Retain Value • Exchange Value • Build Value • Define Value	• Social Value • Capture Value • Retain Value • Exchange Value • Build Value • Define Value
R2 RESELL/REUSE *New Retail Build*	The main focus here uses market principles to ensure materials and products through specification and procurement are used as second-hand in the economy after initial purchase and use. A secondary focus would be the need for the designer to consider and design for defitting in the future, identifying materials and products to be redeployed into another new or existing premises.	• Social Value • Retain Value • Build Value • Define Value • Value Chain?	• Social Value • Retain Value • Build Value • Define Value • Value Chain?	• Social Value • Retain Value • Build Value • Define Value • Value Chain?
R2 RESELL/REUSE Existing Retail Build	The main focus here uses market principles to ensure materials and products through specification and procurement are used and maintained within the existing retail build or used as second-hand elsewhere. The secondary focus would be for the designer to consider what can be reused and redeployed within a refurbishment or repurposing of an existing retail environment or what can be resold.	• Social Value • Use Value • Exchange Value • Capture Value • Retain Value • Build Value • Define Value • Value Chain?	• Social Value • Use Value • Exchange Value • Capture Value • Retain Value • Build Value • Define Value •Value Chain?	• Social Value • Use Value • Exchange Value • Capture Value • Retain Value • Build Value • Define Value • Value Chain?
R3 REPAIR *New Retail Build*	The main focus here is to bring back to working order, however should not be confused with 'refurbishment'. **In the case of a new retail build the focus should be on procuring second hand even if doing so may require some repair**.	Not Applicable	• Social Value • Use Value • Exchange Value	• Social Value • Use Value • Exchange Value

Table 1. *Cont.*

Retail Interior Design Value Retention Assessment Rubric				
Waste Minimisation	**Description**	**Environment**	**FF & E**	**Materials**
R3 REPAIR Existing Retail Build	The main focus here is to bring back to working order, however in the case of retail environment including material repair would fall under 'refurbishment'. For existing builds repair may mean patching and respraying chipped joinery or patch, repair and repaint existing plasterboard ceilings and walls—a very common but important note on drawings.	Not Applicable (See Refurbish)	• Social Value • Capture Value • Retain Value • Exchange Value	• Social Value • Capture Value • Retain Value • Exchange Value (See Refurbish)
R4 REFURBISH *New Retail Build*	Understood to be an overall 'upgrade' or revival of a retail environment, especially where structural and/or finishes and materials are reused or repaired. In the case of a new retail build the focus can be on design for refurbishment in the future. Fixtures and fittings would fall under Existing Retail Build *Repair.*	• Social Value • Capture Value • Build Value • Define Value	Not Applicable (See Repair)	• Social Value • Capture Value • Build Value • Define Value
R4 REFURBISH Existing Retail Build	Understood to be an overall 'upgrade' or revival of a retail environment, especially where structural and/or finishes and materials are reused or repaired. In the case of an existing retail build the focus would be the retail environment structure and surface finishes, fixtures and fittings.	• Social Value • Use Value • Retain Value	Not Applicable (See Repair)	• Social Value • Use Value • Retain Value
R5 REMANUFACTURE *New Retail Build*	The focus here is on making like new condition from second-hand material or product.	Not Applicable	May be applicable where designer chooses to use restored fixtures and fittings	May be applicable where designer chooses to use restored materials
R5 REMANUFACTURE Existing Retail Build	The focus here is on making like new condition from second-hand material or product.	• Social Value • Use Value • Retain Value	• Social Value • Use Value • Retain Value	• Social Value • Use Value • Retain Value
R6 REPURPOSE *New Retail Build*	Reflects artistic or industrial design areas where something is partially reused or refashioned in some respect that is different to its original purpose. Where discarded products or components are adapted for a different function, such as a sculpture or cannibalised machinery from one product to create or repair another.	Not Applicable	**Social Value**: May be applicable where designer chooses to repurpose used fixtures and fittings from elsewhere	**Social Value**: May be applicable where designer chooses to repurpose used materials from elsewhere
R6 REPURPOSE Existing Retail Build	Reflects industrial design or artistic areas where something is partially reused or refashioned in some respect that is different to its original purpose. Where discarded products or components are adapted for a different function, such as a sculpture or cannibalised machinery from one product to create or repair another.	**Social Value**: A change of use could be understood as repurposing an existing retail environment	• Social Value • Use Value • Capture Value • Grow Value	• Social Value • Use Value • Capture Value • Grow Value
R7 RECYCLE MATERIALS *New Retail Build*	Recycle pertains to more than fitout materials, it includes harvesting spare parts of fixtures, fittings and furnishings to use in repairs as well as breaking down and recycling of materials, fixtures and fittings that make up the build. Designers need to be mindful to design using mechanical fixings and jointing methods wherever possible that do no contaminate in some way or cause difficulty in separation for later recycling. The use of glues are a particular barrier in this regard to recycling. The main focus here should be on good client communication and design based upon Refuse, Reduce, Reuse and so on. Whilst recycling is understood as the recovery of existing materials and products, it is in fact the least efficient and least desirable circular process.	Not Applicable	May be applicable where designer chooses to use recycled materials within fixtures and fittings	May be applicable where designer chooses to use recycled materials

Table 1. *Cont.*

Retail Interior Design Value Retention Assessment Rubric				
Waste Minimisation	**Description**	**Environment**	**FF & E**	**Materials**
R7 RECYCLE MATERIALS Existing Retail Build	Recycle pertains to more than fitout materials, it includes harvesting spare parts of fixtures, fittings and furnishings to use in repairs as well as breaking down and recycling of materials, fixtures and fittings that make up the build. Designers need to be mindful to design using mechanical fixings and jointing methods wherever possible that do no contaminate in some way or cause difficulty in separation for later recycling. The use of glues are a particular barrier in this regard to recycling. The main focus here should be on good client communication and design based upon Refuse, Reduce, Reuse and so on. Whilst recycling is understood as the recovery of existing materials and products, it is in fact the least efficient and least desirable circular process.	Not Applicable	• Social Value • Use Value • Capture Value • Grow Value	• Social Value • Use Value • Capture Value • Grow Value
R8 RECOVER *New Retail Build*	(1) collecting used products/materials at their end-of-life from existing built or demolished environments (2) extracting elements or materials from end-of-life or demolished environments (3) capture or production of energy with waste material—for example incineration to create heat	Not Applicable	Not Applicable	Not Applicable
R8 RECOVER Existing Retail Build	(1) collecting used products/materials at their end-of-life from existing built or demolished environments (2) extracting elements or materials from end-of-life or demolished environments (3) capture or production of energy with waste material-for example incineration to create heat	• Social Value • Use Value • Exchange Value	• Social Value • Use Value • Exchange Value	• Social Value • Use Value • Exchange Value
R9 REMINE *New Retail Build*	The retrieval of materials after the landfilling phase. **IMPORTANT NOTE**: *Circular specification and procurement are critical to de-stigmatise the use of second hand, repaired, refurbished, repurposed, remanufactured, recovered or remined materials, fixtures and fittings within a new or existing build.*	Not Applicable	Not Applicable	Not Applicable
R9 REMINE Existing Retail Build	The retrieval of materials after the landfilling phase. *Recover* is more relevant to existing retail built environment. **IMPORTANT NOTE**: *Circular specification and procurement are critical to de-stigmatise the use of second hand, repaired, refurbished, repurposed, remanufactured, recovered or remined materials, fixtures and fittings within a new or existing build.*	Not Applicable	Not Applicable	Not Applicable

Value chain—Relates to future skills and services necessary to maximise product and material lifecycle regeneration through the development of a circular design ecosystem as the template for a circular economy.

These preliminary four platforms provide the basis for retail interior designers in the future to better adapt or translate their patterns of thinking as circular solutions around problems and represent a valuable new framework (Figure 2). Lockton et al. (2013) tell us that the use of patterns is not primarily about idea generation, or at least not in the forms generally presented. They point out that where there are multiple possible solutions to a problem and the principles are abstract enough to require some form of adaptation or translation to see how they might be applied to a problem in question, then sets of patterns can be part of an idea generation process [37].

Figure 2. Diagram presents the four proposed progressive education platforms.

4. Discussion

Bocken et al. (2016) discuss how multiple business models and design strategies, approaches, methods and tools will be necessary to support the move toward a circular economy. [13]. The argument we pose here is that this type of preliminary thinking around business models and design strategies is flawed from the outset.

Brocken et al. (2016) also categorise a number of design strategies:

The first two strategies within *Designing of long-life products* are based on branding, brand loyalty, quality, intuitive and aesthetic design:

- Design for attachment and trust
- Design for reliability and durability

The following four strategies within *Design for product-life extension* are clearly based in modular design, design for customisation and functionality:

- Design for ease of maintenance and repair
- Design for upgradability and adaptability
- Design for standardisation and compatibility
- Design for dis- and reassembly

The final three listed strategies within *Design strategies to close loops* are based in systems design

- Design for a technological cycle

- Design for a biological cycle
- Design for dis- and reassembly [13]

From a design education perspective, designers already use these principles but are continuously compromised by the existing pressure from operating within a service-based linear economic model. Bakker et al. (2014) place a product's economic viability at the forefront when discussing how to optimise product lifespan from a sustainability perspective and argue the main challenge for design research will be to determine when to apply which product life extension strategy [38]. Once again, this is posited within the 'service' industry providers' understanding of design, not appreciating how design can provide lead to influence behaviour.

Research into how the design of the product and its behaviour directly influences the behaviour of the user can be understood as that of a throwaway society which directly stems from the design of throwaway products in the first place [39]. The impact of design upon behaviour with regard to developing a circular economy is also considered in *Design for Circular Behaviour* [40], where two key points are highlighted:

- To define what user behaviour, if any, is required to enable a transition to a more circular economy
- To create a framework for designing products and services to encourage desired circular behaviours

In both cases above, the authors advocate the power of design and the important role that design should play. Explaining that products should not only be designed with a focus on how design principles allow products to fit within a circular economic system but also on how products can be designed to ensure patterns of ecologically sustainable behaviour. In terms of design education, this is a key statement and strategy for any new retail design educational paradigm.

Renee Wever (2012) reminds us how architects in the past have endeavoured to create their vision for a better world. He introduces the example of the Amsterdam School, a Dutch architectural movement from the early 1900's classified as expressionist architecture. Their designs for working-class dormitories were intended to change the way people lived by teaching the working class how to live. For example, where to place a table, where a lamp should be hung, and where their bed should stand [41]. By today's standards, this may seem quite condescending and even offensive. However, one could argue that today's design lifestyle programs provide a similar service for those who are not designers under the guise of fashion and taste. This approach does consider the layout and use of space in conjunction with the product as fixtures and fittings but still ignores the actual construction and fit-out process, and thus a new educational strategy is required for designers, product manufacturers, clients, and end users here.

The research paper *Skills and Capabilities for a Sustainable and Circular Economy* (2017) ask how the role of design is changing with the arrival of sustainable business strategies and, in addition, asks what design competencies are required to perform more effectively within sustainable business models [42]. Once again, this is the wrong question, as it places the sustainable business model as the driver when it needs to be understood as the vehicle. More critically, it is the role of the designer (in the design of the best vehicle possible) that impacts the drivers' behaviour.

Human-centred design, end-user and user-experience design (UX) all relate to the study of user behaviour and understanding their needs by placing the user at the centre of the design process. Wever et al. (2008) tell us that past sustainability approaches have focused on fulfilling functions more sustainably within a given use profile. They argue that user-centred sustainable solutions can provide an alternative strategy where the aim would be to change the use profile in a more sustainable direction [43].

If we consider this argument in the context of interior design and retail built environments, it is unclear who the end user is. Are the end-users using a built environment or creating it, or both? Unlike product design, the majority of end-users of a built environment would tend to continually influence or alter the look and use of space through personal

need and/or customisation—as in interior decoration in residential design and fit-out within retail or commercial interior design. Again, unlike product design, the selection and use of construction, fabrication and fit-out materials, as well as the selection of products such as fixtures, fittings, furniture and equipment within interior design, highlights a need to alter behaviour as a culture within a whole industry, whether it is residential interior design or commercial retail interior design.

5. Conclusions

This research provides a significant and novel step forward. This research has established a solid foundation for designers, particularly interior designers and architects, to begin to alter unsustainable behaviour through the design process and rebuild a sustainable culture through design and construction processes for the built environment now and in the future. At the same time, it also provides a much more realistic and effective template for a circular economy.

Novelty exists in the new way in which this is looked at, how each of the four building blocks has been developed, their relationship and their use within the context of learning and teaching interior design in the future. More importantly, as a system, they provide a unique approach, a new and novel template to identify design knowledge gaps within a complex built environment design industry and to progressively address each gap through future built retail environment development and/or research.

It is the structure and relationship of the content within the four building blocks where novelty now exists in (1) waste management or the Ten R's as it allows designers to consider all options and possibilities and even create new ones specifically for the needs of a sustainable built environment. Novelty exists within (2) ecovalue as it allows designers to not only consider value from other perspectives beyond basic economics but to use design to add or grow value, to better capture value and, most importantly, define and maintain future sustainable social value. Novelty exists in (3) design thinking in the way in which design skills and methodology are presently used to sell more unnecessary or wasteful products. In this context, they are now used to alter the built environment construction and fit-out culture and behaviour toward automatic or natural sustainability. Novelty exists in (4) design ecosystems, allowing designers to go beyond cradle-to-grave and cradle-to-cradle concepts. They design to minimise waste at all levels and maximise sustainable use of resources and materials becomes a natural habit.

Novelty exists in the four building blocks providing a deeper and more effective understanding of what a circular economy is or should be. The four interrelated teaching and learning principles provide a chain of reasoning for ideas generated as circular design within a new retail interior design paradigm. In turn, this provides direction to scaffold what interior design students need to learn and how they should learn with regard to circular design and understanding the consequences of any decisions made.

High Impact Teaching Strategies (2019) explains how the scaffolded approach provides smooth transitions between activities, ensuring students can build on prior knowledge, identify links between activities, and discern the relevance of those activities [44]. Helen Kopnina (2017) argues that education in sustainability typically involves the development of student understanding of sustainable production strategies and the environmental consequences of selections or choices [45].

This research provides a set of preliminary design principles to form a new retail interior design education methodology with sustainability at its core. The detail of this methodology will come through further research development.

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