

Upcycling and Material Value in Functional Art: Recycled Paper and Plastic in Art and Craft Education

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ABSTRAK

Isu keberlanjutan dan meningkatnya limbah material mendorong berkembangnya berbagai pendekatan kreatif dalam pemanfaatan kembali material bekas, salah satunya melalui praktik *upcycling*. Dalam konteks pendidikan seni dan desain, praktik ini tidak hanya berfungsi sebagai teknik pengolahan material, tetapi juga sebagai sarana pembelajaran yang membangun kesadaran terhadap nilai material. Penelitian ini bertujuan mengeksplorasi nilai *upcycling* dalam pembelajaran *art and craft* melalui proses penciptaan karya seni fungsional. Penelitian menggunakan pendekatan *practice-based research* dengan objek kajian berupa pembuatan *notebook* dari kertas dan plastik daur ulang. Data dikumpulkan melalui dokumentasi visual proses dan produk akhir, refleksi tertulis mahasiswa, serta catatan reflektif dosen selama pembelajaran berlangsung. Hasil penelitian menunjukkan bahwa praktik *upcycling* tidak hanya mentransformasi material limbah menjadi produk baru, tetapi juga mendorong terbentuknya pemahaman multidimensional mengenai nilai material yang mencakup fungsi, estetika, makna, serta potensi keberlanjutan siklus material.

Kata Kunci: *upcycling*, literasi material, desain sirkular, *art and craft*, pendidikan desain

ABSTRACT

Sustainability issues and the increasing amount of material waste have encouraged the development of creative approaches to reuse discarded materials, one of which is the practice of upcycling. In the context of art and design education, this practice is not only a way to work with materials but also a way to learn about which materials are valuable. This study seeks to explore the value of upcycling in art and craft education through the process of creating functional artworks. The research uses a practice-based research approach as a method, focusing on the creation of notebooks made from recycled paper and plastic. Data were collected through visual documentation of the process and final product, written reflections from students, and reflective notes from the instructor during the learning process. The findings indicate that upcycling practices transform waste materials into new products and encourage the development of a multidimensional understanding of material value, including function, aesthetics, meaning, and the potential continuity of material life cycles.

Keywords: *upcycling*, material literacy, circular design, art and craft, design education

INTRODUCTION

Industrial development and mass consumption patterns have significantly improved the quality and variety of products. However, these developments have also contributed to a substantial increase in global waste production at both industrial and household levels (Kaza et al., 2018; United Nations Environment Programme, 2021). This issue extends beyond the mere accumulation of waste; it inherently involves the management of the product lifecycle. In the context of sustainability, materials are not just seen as things that will be thrown away. Instead, they are considered part of a circle that can be reimagined through new art and

design methods. Upcycling focuses on increasing the value of materials through creative and design-oriented processes, whereas recycling generally converts materials back into raw form (Sung, 2015). Through upcycling, discarded materials are reinterpreted into new products that possess functional, aesthetic, and symbolic value (Sung et al., 2014). This process not only reduces waste but also opens opportunities for designers to explore material characteristics and develop new design possibilities (Ceschin & Gaziulusoy, 2016; Karana et al., 2015). In the context of design practice, material characteristics such as texture and visual qualities also contribute significantly to the formation of aesthetic value (Syamsiar, 2021).

Over the past two decades, the practice of upcycling has gained momentum in the fields of art and design as part of a sustainable design approach. Numerous studies demonstrate the transformation of waste materials into products serving both functional and aesthetic purposes which shows the transformation of plastic waste, once deemed worthless, into practical works of art (Asamoah et al, 2025). Multilayer plastic, which is typically difficult to recycle, can be transformed into functional products for everyday use such as bags, wallets, book covers, etc. This indicates that upcycling functions not only as a waste reduction strategy but also as a design approach that enables the exploration of aesthetic value and material potential. Within the context of art education, the utilization of waste materials as creative media has been shown to enhance both functional outcomes and creative expression in learning processes (Syamsiar, 2021)

As sustainability issues are becoming increasingly important in art and design education, art and craft education not only enhance student technical skills but can also cultivates creativity, comprehension of material properties, and an awareness of more responsible design methodologies (Zhou & Rognoli, 2021). In practice, using recycled materials in education is often seen as a way to save money or reduce waste. Consequently, the potential of upcycling as a process for exploring the value of materials and as a mean to understand a product's life cycle has not yet been fully harnessed within the educational context (Ahn & Lee, 2018; Sung, 2015)

A sustainable design approach says that a product's value comes from more than just how it looks and works. It also comes from its story, how it feels to use, and how it affects the environment. In the cradle-to-cradle concept, Braungart & McDonough (2002) explain that materials should be understood as part of an ongoing cycle, not as products that ultimately become waste. This perspective prompts designers to reconsider the relationship between materials, their functions, and sustainability right from the outset of the design process. In this context, upcycling is a design approach that helps maintain the material cycle by creating new products from existing materials.

However, most existing studies primarily emphasize product innovation and material transformation outcomes (Chapman, 2015). Current research shows a lack of studies on the teaching methods and ideas behind upcycling in functional art education. Although several studies have demonstrated that waste materials can be transformed into products with aesthetic and economic value, research highlighting how these practices influence student perceptions of materials, the value of products, and the potential for material transformation after the end of their useful life remains relatively limited. Consequently, studies on upcycling have largely focused on product innovation and production techniques, while the exploration of its value within the art education process has not yet been thoroughly examined.

This study aims to examine the significance of upcycling in art and craft education by producing functional artwork. Specifically, this study focuses on the creation of

notebooks from recycled paper and plastic as a medium for understanding how the process of material transformation can foster a multidimensional understanding of material value, encompassing function, aesthetics, meaning, and the potential for a sustainable material cycle.

This study employs a qualitative approach using practice-based research methods combined with pedagogical reflection. This investigation centers on the development of notebooks crafted from recycled paper and plastic, serving to explore how material transformation can cultivate a multifaceted comprehension of material value. This encompasses functionality, aesthetic qualities, symbolic significance, and the potential for a sustainable material cycle. This methodological choice was informed by the research's origins in the practice of creating artworks within the framework of art and craft education, where the creative process is fundamental to knowledge acquisition. In practice-based research, the act of creation not only yields physical objects but also generates conceptual understanding through direct engagement and critical reflection on the process (Candy & Edmonds, 2018; Smith & Dean, 2009). Therefore, this study views the artwork and its creation process as primary sources of data. This study views the process of creating a work as a form of inquiry, in which creative practice serves as a medium for understanding material values in the context of design education.

The research was executed in a collegiate art and craft course with four students participating. The number of participants was selected through purposive sampling to allow for in-depth observation of the creative process and reflection on the material throughout the project. Although the number of participants was relatively small, it was considered appropriate for this practice-based study because each student was intensively observed and guided throughout every stage of material exploration, product development, and reflective evaluation. This intensive engagement generated sufficiently rich qualitative data to examine the relationship between sustainable material experimentation and creative practice. Each student produced a notebook made from recycled materials, using recycled paper for the pages and recycled plastic for the cover. The first step in making the product was to make the recycled paper from gathering scrap papers, processing the papers into pulps, reshaping the pulps into sheets, and drying them to form new papers. The second process is to melt and bond the recycled plastic into a solid sheet for the cover. Next, the students designed and assembled the notebooks, taking into account aspects of function, structure, and visual composition. Practice-based research positions creative practice as a form of inquiry where knowledge is generated through making and reflective engagement (Gray & Malins, 2016). In this approach, the result and its creation process function as primary sources of knowledge, emphasizing the role of practice as both method and outcome.

Research data was collected through three main sources: visual documentation of the process and final products, students' written reflections, and instructors' reflective notes taken during the learning process. Students' reflections were collected in the form of narrative writings after the project was completed, guided by open-ended questions regarding their experiences with material transformation, design considerations, perceptions of value enhancement, and possibilities for further reprocessing. Visual documentation included the initial condition of the materials, the stages of transformation, and the results of the works. Instructors' reflective notes were used to supplement our understanding of the dynamics of the learning process and student responses. The role of instructors as researchers is understood as part of a reflective approach within practice-based research.

A descriptive-reflective thematic analysis approach was used to look at the data. The analysis was conducted using an interpretative approach to identify patterns of meaning-making regarding material transformation in the learning process. The first stage involved reading all reflections and documentation to identify recurring statements relevant to the research focus. The second stage involved the initial coding of nascent units of meaning, encompassing alterations in material characteristics, functional and aesthetic considerations, perceptions of value augmentation, and awareness of the recycling process. The subsequent stage necessitated the organization of these codes into more expansive conceptual themes, specifically material transformation, value elevation, the non-finality of artworks, and pedagogical ramifications. The use of purposive sampling in this study is intended to enable in-depth exploration of students' experiences rather than statistical generalization, which is consistent with qualitative research approaches (Creswell & Poth, 2017). Interpretation was undertaken iteratively, consistently linking empirical observations to the theoretical framework of upcycling and the circular paradigm within design education. To bolster the credibility of the findings, this investigation utilizes data triangulation, integrating students' reflections, visual documentation, and instructors' notes. Consequently, this study not only elucidates the technical practices of material upcycling but also investigates the shifts in perception and meaning that arise from sustainability-focused creative experiences within the domain of art education.

DISCUSSION

The findings of this study were obtained through a descriptive-reflective thematic analysis of data collected from students' written reflections, visual documentation of the process and final works, and instructors' reflective notes during upcycling practices in art and craft education. The interpretative analysis aimed to clarify the significance derived from students' experiences, concentrating on material transformation, value assessment, and sustainability consciousness. This analytical process unfolded through several interconnected phases. Initially, a thorough examination of all data was undertaken to pinpoint recurring statements pertinent to the study's central questions. Subsequently, preliminary coding was implemented on the emerging units of meaning, encompassing changes in material properties, functional alterations, aesthetic attributes, perceptions of enhanced value, and awareness of material cycles. The third stage involved the categorization of these codes into conceptual themes, based on shared meanings and interconnections among the diverse categories. The interpretative process was iterative, consistently linking empirical observations to the theoretical framework of upcycling and the circular design paradigm within design education.

To ensure the transparency and credibility of the analysis, the process of transforming data from raw reflections into conceptual themes is presented in the form of a thematic mapping in Table 1. This table illustrates how students' narrative experiences were subtracted into analytical codes and then synthesized into the main themes that form the basis of the discussion. Code selection was based on frequency of occurrence and relevance to the research focus, while theme grouping was based on conceptual links between material transformation, value formation, and sustainability awareness within the design context.

The analysis yielded five main themes: (1) material transformation, (2) material value exploration, (3) value elevation, (4) material continuity, and (5) pedagogical implications. These five themes form a progressive relationship, in which material transformation serves as the foundation for value exploration, which then evolves into the elevation of material value, an understanding of the sustainability of material cycles, and

ultimately pedagogical implications for design education. This relationship demonstrates that upcycling practices produce design artifacts and shape students' thinking about materials as part of a sustainable system. The findings of this study point to the understanding that material-based design practices can serve as a medium for building material literacy and awareness of a more circular design paradigm.

Based on this thematic structure, the subsequent discussion is organized to elaborate on each theme step by step. The initial discussion centers on material transformation, elucidating the physical and conceptual alterations of materials experience throughout the creative endeavor. Subsequently, material value exploration examines how students begin to interpret materials within a design framework, which subsequently develops into value elevation, the process of augmenting a material's worth concerning functionality, aesthetics, and significance. The subsequent theme, material continuity, underscores the dynamic nature of materials, which exist within an ongoing cycle of transformation. Finally, the entire process is analyzed in terms of its pedagogical implications, demonstrating the role of upcycling practices in cultivating material literacy and sustainability awareness within art and design education.

Table 1. Thematic Mapping of Students' Reflections in Upcycling Practice

Student Reflection	Analytical Code	Conceptial Theme
<i>"The recycled paper exhibits a unique and distinctive texture."</i>	Material reconfiguration	Material Transformation
<i>"The pulp-making process helped me realize that discarded materials can be transformed into new forms."</i>	Material transformation awareness	Material Transformation
<i>"I was surprised to discover that discarded plastic could be transformed into a durable notebook cover."</i>	Functional adaptation	Material Transformation
<i>"I realized that materials once considered waste can be repurposed into something useful."</i>	Material redefinition	Material Transformation
<i>"The uneven texture of the recycled paper made it more visually appealing."</i>	Aesthetic emergence	Material Value Exploration
<i>"Discarded materials possess unique visual characteristics that cannot be found in new materials."</i>	Material uniqueness	Material Value Exploration
<i>"The product felt more valuable because it was made from recycled materials."</i>	Perceived value shift	Value Elevation

<i>"I realized that discarded materials can be transformed into viable design products."</i>	Value reinterpretation	Value Elevation
<i>"The notebook can be recycled again after it has reached the end of its use."</i>	Recyclability awareness	Material Continuity
<i>"The work did not feel final, as it could continue to evolve over time."</i>	Non-final artefact perception	Material Continuity
<i>"The experience made me more aware of the importance of material choices in design."</i>	Material awareness	Pedagogical Implications
<i>"The experience helped me develop a deeper understanding of the material life cycle in design."</i>	Lifecycle understanding	Pedagogical Implications

Table 1 is designed to show a clear and systematic transformation of qualitative data into conceptual findings. The column of student reflection excerpts shows the primary empirical evidence that comes from the participants' experiential engagement in the upcycling process. These reflections were then interpreted through analytical coding, which is an intermediate step to find recurring patterns of meaning associated with material transformation.

1. Material Transformation

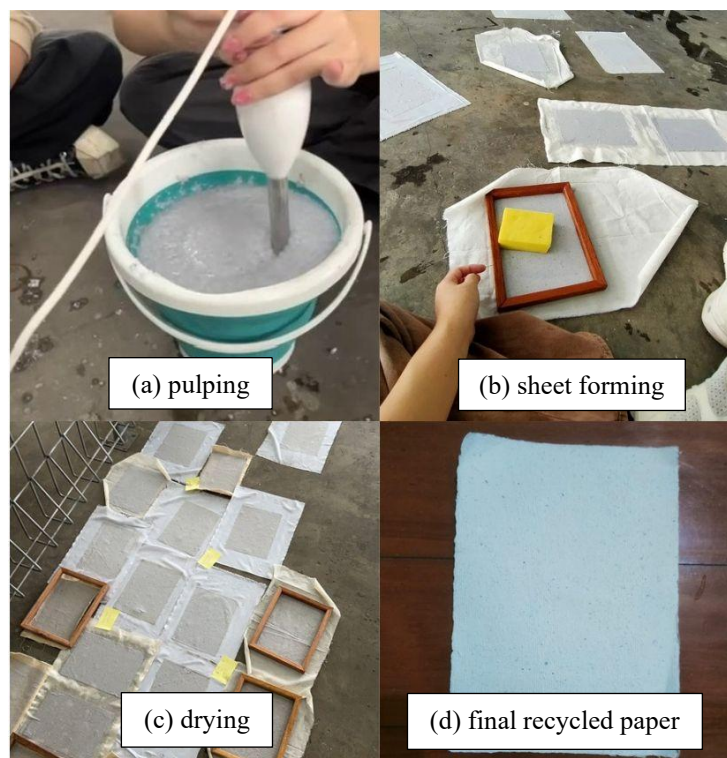


Figure 1. Material Transformation Process in Upcycling:

(a) paper waste processed into pulp using a hand blender, (b) sheet forming using a mould and deckle, (c) drying newly formed recycled paper sheets, and (d) the final recycled paper produced for notebook pages.

The first theme identified from the analysis results is material transformation, which represents changes in materials, both physical and conceptual, through upcycling practices. This theme emerged from recurring patterns in the students' thoughts, indicating a change in perspective on used materials, from being seen as waste to being seen as materials with design potential. This finding suggests that material transformation occurs not only at the physical level but also at the conceptual level. In practice, the transformation of materials occurs through various creative methods, such as the direct alteration of scrap paper and plastic. This process commences with the disintegration of scrap paper into pulp, followed by the formation of new sheets, and concluded by drying to produce recycled paper. Meanwhile, used plastic undergoes melting and fusing to form a solid sheet that serves as a cover for the notebook.

The transformation process includes several steps, such as pulping, sheet forming, and plastic melting, as seen in Figure 1. These steps lead to significant changes in the material's forms. Visual documentation shows how things that were once thought of as scraps can be reconfigured into functional goods. The materials that come out of the process have different physical properties than the starting materials, which shows that transformation is not just a technical change but also a way of recycling materials.

Based on the students' reflections, changes in material properties are a key aspect in understanding the design potential of the recycled materials. One student said, "Recycled paper has a unique texture that is different from regular paper." This suggests that the qualities of transformed materials can create textured effects that new materials can't. Additionally, other reflections indicate that materials previously deemed to have no functional value can be processed into a new recycled product design, such as recycled plastic used as a notebook cover.

From a pedagogical perspective, the instructors' reflections show that students initially struggled with the materials' inconsistent qualities. However, as the project continued, students began to adjust their design process based on the materials' characteristics. This suggests that recycling materials isn't just a technical skill; it's also a part of a learning process that builds a connection between the designer and the material. These findings indicate that upcycling practices play a role in developing sensitivity toward materials as an integral part of the design process.

Conceptually, these findings indicate that material transformation through recycling is an initial stage in the process of attributing meaning to materials in design. The physical transformations that occur through creative practice foster the development of new understandings regarding the potential of materials as dynamic design resources. The initial stage of material transformation is essential for subsequent investigations into its value within the design process. This aligns with the concept of material experience, where materials are understood not only through their physical properties but also through sensory and interpretative engagement in the design process (Karana et al., 2015).

2. Material Value Exploration

Material value exploration, the second theme identified in the study, elucidates how students begin to understand and interpret the value of materials in a design context following a transformation phase. This stage highlights the importance of evaluating, assessing, and understanding materials as essential part of the design decisions, unlike the

previous stage, which solely focused on physically changing the materials. These findings indicate that upcycling techniques help us understand material properties, in addition to changing their form.

The analysis of students' reflections reveals that the examination of material worth stems from direct engagement with the heterogeneous characteristics of the recycled materials. For instance, recycled paper exhibits a rougher texture, varying thickness, and inconsistent coloration. Simultaneously, melted plastic presents stiffer properties and unusual visual patterns. These conditions encourage students to adapt their design approaches by considering both the limitations and the potential of the materials used. This shows that used materials still have value, even if their function changes in the new design. Moreover, from an aesthetic perspective, upcycling creates a unique visual quality that isn't found in original commercial forms.

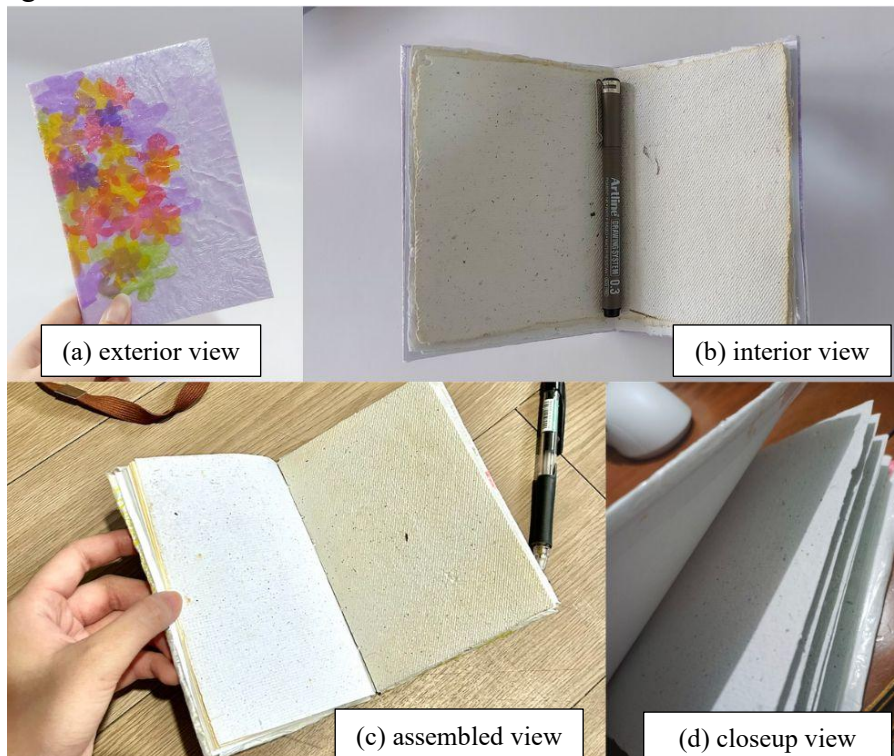


Figure 2. Final Upcycled Notebook Produced by Students: (a) Exterior view plastic cover, (b) interior view recycled and recycled plastic cover, (c) assembled notebook (d) close-up view

The completed upcycled notebooks exhibit distinctive structural and aesthetic characteristics, as illustrated in Figure 2. Unlike typical industrial goods, the irregular surface of recycled paper and the layered appearance of melted plastic create a unique visual identity. The translucent plastic cover preserves traces of its original material through overlapping layers, color variations, and embedded decorative fragments, producing a handcrafted aesthetic that cannot be replicated by industrial manufacturing. Rather than concealing the recycled origin of the material, the cover intentionally exposes these characteristics as part of the notebook's visual identity. Observations indicate that these material characteristics are perceived as design possibilities, shaping the final object's identity instead of limiting it.

Reflections from students show that opinions about the worth have changed. One student suggested that "the uneven texture actually makes the result more interesting," implying that imperfections in appearance could be seen as having character and aesthetic value. Another statement indicated that the usefulness of the materials used in the product's structure and function is now considered valuable, rather than their original state as waste. These findings suggest that assessing material value involves a process of reinterpretation, where value is determined by experience and the context of use, along with the need for new materials. This shift reflects the idea that material value is not inherent but constructed through context, interaction, and meaning-making processes within design (Krippendorff, 2006). Furthermore, the appreciation of irregularity and imperfection supports the notion that user perception and emotional response play a crucial role in defining aesthetic value (Norman, 2007).

From a pedagogical perspective, instructors' reflective notes indicate that students are beginning to develop sensitivity towards material characteristics, which then being integrated into the design process. Students no longer attempt to "equate" recycled materials with original materials but begin to accept and utilize the unique characteristics of these materials as part of their design strategies.

3. Value Elevation in Upcycling

Value elevation, the process of augmenting material value through design interventions within upcycling, constitutes the third theme identified in the analysis. Initially, students examined the material's inherent qualities. This value then increased as meaning, function, and aesthetics were combined in the final product. Consequently, this outcome indicates that the design process not only uncovers but also cultivates material value.

The analysis reveals that the enhancement of material value occurs in a multidimensional manner. First, regarding functionality, recycled materials undergo a redefinition of their role and become new products that serve a tangible purpose. Recycled paper, for example, is not only a writing surface; it also has tactile qualities that affect the user's experience. Similarly, melted and reshaped plastic waste serves as a protective cover that provides strength to the product. This demonstrates that post-consumer materials do not lose their functional value but undergo function transformation in the context of a new design.

Second, from an aesthetic perspective, upcycling produces a distinctive visual quality not found in conventional materials. Students' reflections indicate that material imperfections, such as uneven textures or inconsistent colors, are perceived as aesthetically valuable. One student articulated that "the result looks more interesting because it is imperfect," implying that the aesthetic value of upcycling techniques is determined by the material's transformation and originality, rather than adherence to uniformity.

This research suggests that aesthetics in upcycling-based design is context-dependent, originating from the process itself rather than solely from the final product. Furthermore, recycled materials are increasingly recognized as integral to sustainable design methodologies. Students exhibited an understanding of resource utilization and the environmental impact of recycled materials. This comprehension is evidenced by reflections that highlight the finished products' dual role in conveying a message of sustainability and

providing practical utility. As a result, the symbolic dimensions produced throughout the design process have equal value to the physical and aesthetic characteristics of the materials.

Integrating value considerations into the design process, students focus not only on how to create products but also on how to enhance the quality and significance of the materials used. This suggests that upcycling practices facilitate a transition from a design methodology centered on outcomes to one that encompasses a broader understanding of value. These observations suggest that value elevation constitutes a stage where materials undergo transformation and concurrently gain recognition as valuable design products. This highlights a multifaceted understanding of material value, considering its practical, visual, and representational aspects. Therefore, upcycling methods can be understood as a process that utilizes contextual and reflective design strategies to elevate the worth of materials through alteration. This observation supports the idea of upcycling as a sustainable design methodology, going beyond simple material reuse to increase value. Unlike recycling, which usually breaks down items into their basic parts, upcycling allows materials to keep or even improve their quality when they're repurposed. This shows how upcycling can change the production design from a linear model to a circular one. The increase in value signifies both an improvement in material quality and a step toward recognizing materials' role in a sustainable cycle.

This multidimensional understanding of value corresponds with sustainable design perspectives, where emotional attachment and product meaning contribute to longer product lifespan and reduced consumption (Chapman, 2015). In this context, upcycling not only preserves material resources but also enhances their perceived and experiential value.

4. Material Continuity and the Material Cycle

Material continuity, the fourth theme identified in the analysis, highlights the understanding that materials are dynamic, existing in a constant cycle of change. In the previous stage, materials gained value through the design process; however, students then began to understand that this value goes beyond the final product and is subject to future changes.

This shift in perspective, as indicated by the students' insights, reflects a transition from a linear model of design to a more circular one. The students' reflections reveal an increasing awareness that materials, once transformed into products, retain the potential for further processing. One student articulated this viewpoint, stating, "This notebook can still be broken down and remade again," thereby implying that the ultimate product is not regarded as the definitive conclusion of the design process. Consequently, rather than considering the final output as a fixed endpoint, the students recognize the possibilities for ongoing reconfiguration. This perspective is consistent with circular economy principles, which emphasize continuous material cycles and the elimination of waste through regenerative design systems (Geissdoerfer et al., 2017).

Visual documentation corroborates these observations, showing that altered materials preserve attributes that facilitate reprocessing. For example, recycled paper can be re-pulped, and melted plastic can be reshaped through reheating. This demonstrates that upcycling not only produces novel products but also promotes material sustainability through iterative transformation. From an educational perspective, instructors' reflective observations indicate that direct experience cultivates a progressive comprehension of the content cycle. Initially, students often perceive products as the ultimate result of the design process. Nevertheless, through experience and self-reflection, students progressively acknowledge the protracted life cycle of materials and their potential for recycling. This

highlights the importance of practical experience in fostering an understanding of material sustainability. These observations are conceptually consistent with the circular design paradigm, which conceptualizes materials as elements within a system defined by continuous cycles of use, reuse, and re-transformation. Braungart and McDonough (2002), through their cradle-to-cradle concept, emphasize the importance of keeping resources within a productive cycle, thereby avoiding waste. In this study, upcycling techniques are interpreted as an initial application of this concept within an educational context.

Consequently, material continuity demonstrates how design practice not only generates products but also cultivates knowledge of sustainable material systems. This suggests that a design-centered methodology can cultivate circularity in the use of materials. This comprehension underpins the pedagogical ramifications, which will be examined in the following section, focusing on the cultivation of material literacy and sustainability awareness in art and design curriculum.

5. Pedagogical Implications of Upcycling

The concluding theme derived from the study's results concerns pedagogical implications, demonstrating how upcycling practices facilitate learning within the sphere of art and craft education. Unlike the preceding phase, where students perceived materials as components of a sustainable cycle, the outcomes of this stage reveal that this experience influences not only design outcomes but also students' comprehension and interpretation of the learning process itself. These results support the idea that upcycling methods can be used as a teaching tool, going beyond just the technical aspects of working with materials.

Based on students' response, upcycling approaches seem to help them understand materials better, which is essential for good design. Students learn about material processing techniques and how their natural properties, limitations, and possible uses affect design decisions. This demonstrates the development of material literacy, or the capacity to understand, evaluate, and utilize materials within their specific context. One student articulated a heightened awareness of the relationship between materials and the design process, stating, "I now better understand how materials function in design."

Furthermore, upcycling techniques contribute to the dissemination of sustainability awareness. Students' reflections indicate that working with repurposed materials helps them understand how design contributes to waste reduction and resource optimization. Students began to view materials as part of a system with environmental consequences, rather than merely as design components. These results suggest that the integration of sustainability concepts into design education can be achieved through experiential practices. This aligns with broader educational frameworks that emphasize environmental responsibility through active learning approaches (*Education for Sustainable Development Goals: Learning Objectives*, 2017), which shows that upcycling can function as an effective pedagogical strategy for fostering both material literacy and sustainability awareness in design education (Rognoli et al., 2015).

6. Conceptual Model of Upcycling Value Transformation in Art and Craft Education

This research proposes a conceptual model of upcycling value transformation within art and craft education, as depicted in Figure 3, derived from thematic findings. The model illustrates how students' engagement with the subject matter changes over time through a structured but flexible process, highlighting the connections between the main ideas. The

process begins with materials that are then transformed through various methods, such as pulping, melting, and shaping, as shown in Figure 3. This stage establishes the foundation for material value exploration, where students begin to interpret material characteristics such as texture, form, and visual qualities within a design context.

Value elevation subsequently ensues, wherein materials acquire functional, aesthetic, and symbolic importance via design intervention. This enhanced understanding fosters material continuity, wherein artefacts are perceived as components of an ongoing material cycle aligned with circular design principles, rather than as static products. These interconnected stages ultimately have educational implications, particularly in helping students understand sustainability and material literacy. Furthermore, the method highlights the importance of learning through practice, self-reflection, and working with materials as the core elements that support the entire process of change.

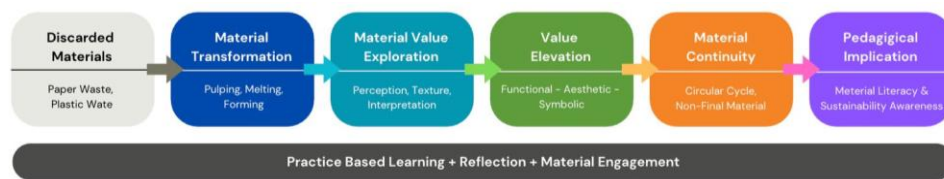


Figure 3. Conceptual Model of Upcycling Value Transformation in Art and Craft Education

The conceptual model presented here highlights the study's originality by framing upcycling as more than just a technical method for reusing materials. Instead, it is depicted as a structured educational approach. This approach integrates creative activities, reflective thought, and design principles focused on sustainability. Through this model, the study offers a new perspective on how material-based design practices can function as a pedagogical tool for developing both conceptual understanding and environmental awareness in art and craft education.

CONCLUSION

This study demonstrates that upcycling practices in art and craft education extend beyond technical material processing and function as a reflective and conceptual learning approach. Through a practice-based research framework, the findings reveal that students' engagement with recycled materials leads to a progressive transformation of understanding, beginning from material transformation, followed by material value exploration, value elevation, and material continuity. These stages demonstrate that materials are perceived as a fluid resource, subject to continuous reinterpretation and reconfiguration within a design framework, rather than being considered fixed or expendable.

Moreover, the research underscores that upcycling fosters the cultivation of material literacy, enabling students to acquire the capacity to comprehend, assess, and apply material characteristics with greater criticality and contextual awareness. As students begin to understand how design influences material cycles and reduces waste, this process is also intimately related to the growing awareness of sustainability. The results indicate that hands-on interaction with materials is crucial for connecting theoretical understanding with practical implementation in design education. This study's conceptual model offers a novel perspective by framing upcycling as a structured learning process that integrates creative practice, reflective thought, and circular design principles. The study's main contribution lies in this paradigm, which shifts upcycling from a material reuse method to a pedagogical

framework that promotes both design thinking and sustainability-focused learning (Geissdoerfer et al., 2017).

From a practical perspective, the proposed five-stage learning model may serve as a reference for art and design higher education institutions seeking to integrate sustainability into studio-based learning. By incorporating sequential activities of material transformation, value exploration, value elevation, and material continuity into studio courses, educators can foster students' material literacy, reflective design thinking, and awareness of circular design principles through hands-on creative practice.

Conversely, the study constraints are attributable to its limited sample and the particular setting of a single art and craft class. Subsequent investigations might broaden the research parameters by utilizing a more extensive and varied sample, examining alternative materials, or implementing the model across diverse design fields. Furthermore, the enduring effects of upcycling-focused learning on students' design behaviors and sustainability practices necessitate additional research. In conclusion, this study corroborates the idea that upcycling can function as a transformative pedagogical strategy within art and craft education, fostering both material consciousness and sustainability-focused design thinking.

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