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Research Article

From Earth to Art: Repurposing Clay Residues into Ephemeral Clay Sculptures of Organic Art and Styles

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The ceramic and sculpture studios generate significant amounts of clay residues, which often end up in landfills, contributing to environmental degradation. This study explores the potential of repurposing these waste materials into ephemeral clay sculptures, addressing both waste management issues and creating opportunities for innovative artistic expression. The research employed a qualitative approach, combining machine milling with artistic experimentation. Clay residues from local ceramic and sculpture art studios were collected, analyzed for composition, and processed to enhance their sculptural properties. A series of workshops with artists explored various techniques for creating ephemeral clay sculptures using these reclaimed materials. The resulting artworks were documented and analyzed for their aesthetic and conceptual advantages; contemporary artistic trends and methodologies; and cultural and environmental repercussions. Clay residues, when properly processed, proved suitable for creating flexible yet intentionally temporary sculptures. The unique properties of the reclaimed clay led to distinctive structures and forms, inspiring new artistic styles reminiscent of organic, earth-based art. The ephemeral nature of the sculptures encouraged artists to explore themes of impermanence, environmental cycles, and the relationship between art and nature.

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1. Introduction

It is important to understand their properties and behaviours in order to know how to source an artist to shape and texturize clay into statues and wares[1][2]. Nielsen[3] notes that however simple each process can be, from determining the amount of clay to be taken to centering the entire bowl on the wheel, all procedures call for skills and creativity from the artist. A change from clay that has not undergone scientific processes to a finished craftwork simply depicts the essence of every human being who is exposed to the world and obeys its rules. People's desire to create art in the form of sculptures or amulets out of clay is sometimes fueled by the need to send environmental messages and narrate stories revolving around nature or cultural diversity[4][5]. Aesthetically pleasing pieces are crafted by the artists with clay scraps and other environmental materials that not only depict the natural beauty of the world but also advocate its conservation[6]. These artists speak through their works of how all elements within creation are related and the importance of protecting the earth for forthcoming generations[7].

Residues of clay, produced during the process of sculpting, are often disposed of, adding to environmental degradation and waste accumulation. Nonetheless, recent developments in

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sustainable art have shed light on the potential of these residues as valuable artistic mediums[8][9]. Through the reutilization of clay residues, artists not only decrease waste but also craft unique, fleeting pieces that resonate with the themes of impermanence and natural cycles[10][11]. The idea of nature art, which involves producing art within and using elements from nature, often underscores the transient and ever-changing characteristics of the natural world[12]. In this context, clay deposits serve as a symbol of the transient beauty of raw materials and the relationship between man and nature. Such a method is not only a challenge to art tradition but also encourages the audience to experience and wish to relate to the natural environment in different approaches that are more meaningful[13][14]. In this case, the residues of clay in nature art will help answer how artistic representations and ecological awareness can be altered by different creative approaches[15]. At the same time, this research seeks to investigate how these techniques can help shift the focus of art into new artistic directions, which will be more natural and ecological[16][17]. Treating clay residues in the nature art's toolbox encourages further discussions on art, nature, and the sustainability of fabrications.

The repurposing of clay residues into nature art and its impact on artistic styles has been interrupted at some point, which is particularly multidisciplinary in nature as it encompasses the ecological aspect, innovation in art, and perception of culture, supports Jean[18]. Clay waste is produced during traditional sculpting processes, most of which is never used and is frequently thrown away, posing a threat to the environment[19]. As a consequence of this problem, sustainable measures in art have become more critical, and this makes it necessary to change the perspective on the sourcing and use of materials[11][20]. The most pressing challenge, however, is to recast the image of these clay residues from worthless wastes to precious artistic materials and resources. Again, Lozano-Miralles et al.[19] share that this transformation requires practitioners to employ waste minimisation methods and practices that add to the cultural meaning and the imagery of the works produced. The adding of spatial clay residues makes it a practical solution as it promotes environmental consciousness and presents an interesting medium of concentration on the themes of impermanence and the beauty of nature[18][21].

Also, subsuming the clay remnants into the list of artistic creations exerts a great influence on the creation of artistic directions[22]. Culturally ingrained art sometimes elicits perspectives of endurance and permanence; nevertheless, the artwork that depicts the aspects of nature, particularly by using clay remnants, calls into question the conventional wisdom of art. The reversal of the hierarchy opens the door towards the development of new forms and aesthetics that are grounded in impermanence, growth, and ecology[23][14]. This shift, therefore, has even cultural consequences. It encourages the critical evaluation of the culture of wastage and worth in society to achieve an understanding of the relationship between people's actions and the environment[8][24]. This study enriches the development of a long-term and multi-faceted view of art and its role in today's world by demonstrating how one can transform abandoned items into art objects[18][25]. The study investigates the following key inquiries: Firstly, however, these are the questions: (1) What type of aesthetic as well as conceptual gains can be derived when using clay residues in nature art? Two: In what way do uses of clay residues contribute to present-day avenues of artistry and processes? In extension, it is relevant to ask the following: (3) What are the cultural and environmental impacts of reassembling clay residues into artistic materials?

Due to their coaxial fluidity, clay residues will be recycled so that less will be extracted to conserve freshwater ecosystems and the biodiversity associated with them. This sustainable practice helps to mitigate the negative effects of mining, including the destruction of habitats and erosion of land, and also supports the regeneration of ecosystems by minimizing the extent of intrusion of industrial mines into natural habitats as desired in SDG 15. The study of work that questions and focuses on the potential of turning clay residues into nature art and its effects on the styles of artworks

that can be created is still a rather underdeveloped field of art and sustainable studies[26]. As much as there is rich literature on sustainability in art practices and the use of natural materials in creating art, there is a dearth of studies concerning clay residue as an organic material in artworks[27]. The above gap calls for more focused research on the methodologies of using clay residues, the aesthetic values, and the conservation benefits of fostering nature art[18][28].

2. Framework: Theoretical perspective

Arising from the foregoing, the study used Material Engagement Theory (MET): a theoretical paradigm that Lambros Malafouris espoused in 2013 concerning the transformation of clay residues into nature art and the resultant impact on artistic styles or contextual perceptions as identified by March[29] and Prezioso[30]. MET thus proposes that cognition is not tied to the head or rather the brain but is embedded in the body, things, and the environment, focusing on the reciprocal relationship of people and things. According to MET, it is the materials themselves that take active parts in the processes of cognition. Malafouris[31] submits that touching is much more than mere manipulation or the acknowledgement of a relation between the self and the material; it is a formative practice, fundamental to how humans think, learn, and invent. Such a point of view changes the focus to the interaction process and the conceptual and creative possibilities that may be hidden in contact with clay residues. About the conversion of clay residues into the art of nature, MET explains how artists regard and manipulate such materials. The textures and colours of clay residues influence the brain and creativity of artists to produce forms deviating from conventional norms. Such an interaction brings out several important aspects about the subject material, which serve in the construction of artistic thinking and creation[31][32][33].

2.1. Distributed Agency and Ephemeral Art

MET also addresses the notion of distributed agency[34], wherein agency is not solely that of the human designer but is distributed amongst the designer and the materials. As Reynolds pointed out[13] and Küttel[35], such distribution of agency is particularly noticeable in natural art, especially when created with such perishable materials as residues of clay. Weathering and erosion play a part in how the material develops throughout time and space; and this supports the idea that material itself actively participates in the artwork-making process[36]. In such a manner, this distributed agency makes the artists not only think and express their ideas but also understand and work with the material and its properties and behaviours that come with its usage[37]. This approach is highly appreciated and corresponds to the notion of nature art that was defined by Knappett and Malafouris[38] as the approach where the environment and the materials used are actively involved in the art process.

Through the materialisation and prompting of an examination of the materiality of artefacts, MET promotes an awareness of the material reality and its consequences, which is sustainable in relation to art[39][8]. The theory requires that the artist interacts with materials in a purposeful way, and upon doing so, the artist is likely to value the material source, nature, and its effects on the environment as postulated by Malafouris[31]. This material consciousness is important in turning clay residues into artworks. Artists do not only recycle waste materials but also practice eco-resistance art[10]. MET implies that this change of perspective results in a change in the culture of society in regards to wastes and values.

2.1.1. Aesthetic and Concepts

The integration of using MET in art, in particular using clay residues in nature art, has great aesthetic and conceptual values. The theory reveals the purpose of the role of the

material in formation, the process of an artist, as well as a viewer[40]. Chalk trades offer insights into how the peculiar qualities of residues might induce the emergence of new artistic paradigms characterized by the aesthetics of decay, the biomorphic, and the entanglement of art and life through the theorization of the material engagement process[7][41]. This theoretical approach makes it possible to expand the understanding of the practical application of clay residues for nature art or to identify new ideas regarding the cognitive, aesthetic, and environmental aspects of this activity[42]. Therefore, while the study employs MET to analyze clay residues in art, the analysis then goes further to consider other latent meanings and the evolution of new forms of art in the present.

Current literature on sustainable art practice, while emphasizing the use of recycled material, fails to provide a systematic approach as to how exactly waste items such as clay leftovers can be converted into workable art material[43]. Although other authors such as Almusaed, Yitmen, and Almssad[44] and Sampah et al.[10] have provided several ways through which sustainability has been applied to art, the specific details of the process and methods used in recycling the clay residues are inadequate. A prerequisite for future research is the development of a conceptual method that helps artists to organize and properly use these materials, collect them, prepare them for use, and, finally, introduce them into works of art. Another aspect of study about clay residues is their aesthetic value in the field of nature art, which has to be further researched[45][46]. Present-day studies are usually more concerned with the large group of natural materials without examining the specific characteristics and potential of clay residues. While discussing postmodern art, Beardsley[14] briefly mentions the idea of art in nature, but he does not discuss how the residues of clay may fit this category. Knowledge of the texture and colour changes, as well as the structure of the particles of the clay residues, can bring much more surprising and valuable insights to the aesthetic approaches in nature esthetic art.

2.1.2. Influence on Contemporary Artistic Styles

Consequently, the effect that clay residues have on contemporary art styles or artistic practices in particular is still one of the less investigated areas. Rating the aesthetics of traditional art, this aesthetic focused on durability and permanency as opposed to the aesthetics of nature art, which may concentrate on them being temporal and on form shapes. So, the use of clay residues or such marvelous goals and techniques goes beyond the mentioned conventions and opens new stylistic perspectives for artists. However, with Nortey and Bodjawah[47] pointing out that there is still even a need to establish more research on how these materials contribute to the eventual documentation and analysis of the stylistic development of arts.

Last but not least, the general cultural and environmental impacts of redefining clay residues as art materials are unknown and require further investigation[18][7]. While Noce et al.[7] give historical and cultural information regarding the significance of clay, they fail to explain how artists today are returning to it in an attempt to be environmentally friendly. The role of the use of clay residues in art in changing public perception of waste and value and contributing towards environmental stewardship is a very important research question[48].

At the core of MET is the idea that materials play an active role in the cognitive processes of creation. Malafouris[31][32][33] argues that the engagement with materials is not merely a passive interaction but a fundamental aspect of how humans think, learn, and create. This perspective shifts the focus from the end product to the process of material engagement, highlighting the cognitive and creative potentials embedded in the manipulation of clay residues. In the context of transforming clay residues into nature art, MET helps explain how artists perceive and interact with these materials. The textures, colours, and forms of clay residues influence the artist's cognitive and creative processes, leading to innovative artistic expressions that challenge traditional norms. This interaction underscores the material's role in shaping artistic cognition and output[33][49].

The Material Engagement Theory (MET) is a theoretical construct that centres on the human-material relationship, emphasising the ways in which materiality shapes cognitive functions and creative processes. It helps to emphasise how materials can impact creativity and sustainability decisions by illuminating the reciprocal relationship between artists and their materials in sustainable art practices. MET aligns with ecological aesthetics, which emphasizes art's capacity to enhance ecological consciousness by integrating nature and aesthetics. It also suggests that sustainability is not just about artistic content but also about the cognitive engagement with materials. MET also aligns with the circular economy, a sustainability model that promotes the efficient use of resources by maintaining products, materials, and resources in circulation for as long as possible. By emphasising material reuse and cognitive adjustments in consumption, it modifies the relationship between artists and consumption and the life cycles of materials. The circular economy operates on a macro level, while MET provides a micro perspective on the mental processes involved in artists' interactions with recycled materials.

The traditional separation between inert materials and human action is questioned by two theoretical approaches: new materialism and Material Engagement Theory (MET). MET highlights the interactive relationship between artists and the materials they use, while new materialism places greater emphasis on the intrinsic actions of the materials themselves. Both approaches emphasize the creative and cognitive dynamics that arise from specific interactions between humans and materials, drawing attention to the transient and transformative nature of these materials. MET is particularly aligned with the environmental humanities, which investigate the cultural, social, and intellectual dimensions of environmental issues. Both theories strongly promote an understanding of the cognitive links between individuals and materials, especially in how objects like leftover clay can enhance ecological awareness. MET clarifies the cognitive processes that lead to more sustainable practices, as seen in artists who use recycled materials to highlight environmental issues. As a result, MET provides a valuable framework for exploring the aesthetic and ecological potential of art, offering deep insights into how artists can champion sustainable practices.

3. Methods

3.1. Research design

This study employs a qualitative research approach to investigate the process and implications of repurposing clay residues into ephemeral ceramic sculptures. A qualitative research approach involves the collection and analysis of non-numerical data to gain an in-depth understanding of a particular phenomenon[50][51]. This method allows researchers to explore complex social and behavioural issues in their natural settings, using techniques such as interviews, observations, and content analysis[50][52]. Busetto, Wick, and Gumbinger[53] express that qualitative research provides valuable insights that inform theory and practice in various fields by focusing on the subjective experiences and perspectives of participants. The research was divided into three phases: material collection and preparation, artistic creation, and evaluation.

3.1.2. Material collection and preparation with Data collection

Phase 1: Collection of Clay Residues

Sources: Clay residues were collected from local pottery studios, ceramic workshops, and art schools.

Documentation: Each batch of clay residue was documented, noting its origin, type of clay, and any previous treatments (e.g., firing, glazing). Material-specific properties of clay residues make clay a natural, earth-derived substance, used for millennia in various forms. Its organic origin connects it closely with nature, making the artistic process more intimate and symbolic. Clay retains plasticity, workability, and responsiveness, even in

residue form. This allows artists to mould and reshape it repeatedly, emphasizing its tactile and transformative nature. The firing process changes clay residues in unique ways due to impurities, affecting colour, texture, and strength[54]. This adds a layer of artistic spontaneity and experimentation, making each sculpture a unique experiment. Impurities in clay residues affect both the creative process and the technical outcomes in ephemeral clay sculpture.

Preparation of clay residues and sorting: Residues were sorted based on texture, colour, and composition[55].

Processing: Larger chunks were broken down, and all residues were sieved to remove impurities. The resulting material was categorized into fine, medium, and coarse textures.

Hydration: The sorted residues were rehydrated to restore plasticity. This involved mixing with water and kneading to achieve a workable consistency. In the first stage, researchers were tasked with collecting clay remnants from various sources such as pottery studios, construction sites, and natural deposits[56]. These materials were then processed and prepared for artistic use through techniques such as wedging, kneading, and shaping. The goal of this stage was to understand the initial state of the clay and how it can be transformed into a workable medium for artistic expression.

Phase 2: Artistic creation

Artistic inspiration: Researchers drew inspiration from natural forms and processes, focusing on themes of impermanence and organic aesthetics.

Design process: Sketches were created to plan the ephemeral clay sculptures. Emphasis was placed on integrating the unique properties of clay residues.

Sculpture creation and techniques: Various ceramic techniques such as hand-building, slab construction, and coiling were employed. Researchers experimented with the textures and forms of the clay residues.

Integration with nature: Sculptures were designed to interact with natural environments. This included considering how they would weather and degrade over time. The second stage involved the actual creation of ceramic artworks using the prepared clay remnants. Researchers were encouraged to experiment with different techniques such as hand-building, wheel-throwing, and sculpting to create unique and innovative pieces. The focus of this stage was on the creative process and the ways in which the researchers engage with the material to produce their artworks.

Phase 3: Evaluation

Artistic evaluation and criteria: Aesthetic value, innovation, and alignment with the themes of nature and ephemerality[57][58].

Environmental impact assessment

Life Cycle Analysis (LCA): Assessment of the environmental footprint of using clay residues compared to traditional materials[19][59].

Life Cycle Stages: The extraction and processing often involve minimal additional processing if using natural clay residues. Lower footprint if residues are locally sourced. Non-toxic and durable, contributing to longer use and less frequent replacement. Clay can be recycled with minimal landfill impact.

Key Metrics: Ease of Implementation: High. Cost: Low, particularly if the clay is obtained from a local source. Carbon Footprint: Low. On average, one kg of clay is assigned 0.5 to 2 kg CO2e.

Energy Consumption: Less than the usual art materials which are unprocessed forms such as paints, pastels, dyes, among others. These methods decrease energy use since there is no firing or minimal firing, as the trays or products are dried naturally.

Water Usage: Low if residues are used without further processing; if not, low.

Sustainability metrics: The loss rate could be reduced, coupled with reduced wastage, energy, and resource consumption by the organization[60].

Cognitive and perceptual study

Interviews and surveys: Selecting twenty (20) participants; artists and viewers of the artworks, to elicit their impressions on the understanding or perceptions of clay residues and the final artworks. The study has observed greater collaboration among ceramicists, environmental artists, and land art practitioners, resulting in innovative hybrid art forms. Qualitative feedback was obtained from art critics, peers, and the general public through exhibitions and interactive installations[61].

Observation: Documenting the interaction of viewers with the sculptures in natural settings. In the final stage, the ephemeral clay works were assessed in terms of their aesthetic value, technical skill, and conceptual depth. Researchers reflected on their creative process, the challenges they faced, and the outcomes of their work. The goal of this stage was to understand the impact of transforming clay remnants into temporary clay artworks on the participants' artistic practice and personal development.

3.3. Study area

The study was conducted in the art studios attached to the Ceramics and Sculpture Departments at Takoradi Technical University, Takoradi, in Ghana. TTU is known for its practical and technical education and thus lays strong emphasis on the arts, particularly ceramics and sculpture. The university art studios create a dynamic environment that encourages creativity in exploration and production processes among students and staff. Takoradi City and its environs are known for their long tradition in pottery and ceramics, which is deeply rooted in the culture of the people. In fact, abundant clay deposits in the area have helped develop over time a thriving pottery industry where artisans produce a wide range of utility and decorative items. This practice not only exemplifies the cultural artistic legacy of the area but also offers a sustainable source of income for numerous local artisans[62][63].

At the art studios, the ceramics and sculpture departments produce a lot of clay residues that may be considered waste products from their activities. The pottery fabrication process produces these residues, which include trimming leftovers, broken fragments, and excess material. The accumulation of such residues causes both ecological and financial problems for the people and activities dealing with these materials, as they are usually disposed of without reuse, further increasing waste management issues[64][65]. It is within this geographical area of concern that the study finds its relevance because it provides a sizeable number of clay residues that were recycled for artistic purposes. Besides the tradition of regional ceramics, along with easy resource availability, these departments make TTU an ideal place to study such transformation of residues into ephemeral sculptures associated with organic art and sustainable practices.

3.4. Data Analysis

Data analysis integrated thematic and visual analysis approaches used to investigate the colour, composition, texture, and other visual elements applied to understand the meaning and messages conveyed by an artwork[66][67]. Thematic analysis was used to identify leading themes and insights derived from interviews and feedback; visual analysis was used to delve into the aesthetic features and artistic styles of sculptures. Such analytical approaches also consider the historical and cultural contexts around the making of the work in addition to the intentions and influences of the artist from the case studies'[68]. All the aforementioned categories of analytical instruments are applied very frequently in fields cognate to art history, cultural studies, and anthropology in order to attain an in-depth comprehension of visual culture and its effects on societies. The researchers found these two analytic tools to be of much utility in explaining and investigating the intricacies of human expression and communication.

3.5. Ethical Consideration

Ethical considerations were the basis for investigating the re-utilisation of clay remains for creating temporary ceramic sculptures, guaranteeing participants' well-being, process integrity of research, and environmental benefit. One of the important ethical prerequisites when studying any subject matter related to humans is informed consent. In so doing, the potential participants were informed about the purpose, procedures, risks, and benefits of the research in a manner that enabled them to make an informed choice about participating. As Israel and Hay declare[69], informed consent was ensured for every participant taking part in the interviews and surveys. Some of the most core of these would be sustainability aspects regarding the extraction and utilization of clay residue. The research further supported these techniques as being friendly to the local ecosystems and communities. The transformation of the waste into clay also reduced the extraction and processing carbon footprint, as proposed in sustainable artistry by Kagan[70]. Full documentation and exposition of methods employed and the outcome were also a show of good integrity for this research. Transparency included making available to the public the research framework, data collection methodologies, analytical procedures, and resulting findings for examination and further verification by the larger academic and artistic communities, according to Resnik[71].

4. Results

4.1. Physical, Chemical, and Aesthetic Characterisation of Clay Residues into Nature Art

Clay residues are essential to the making of sculptures because they affect the sculptures' workability, firing behaviour, and attractiveness. Physical properties like texture, size, flexibility, and water absorption influenced the behaviour of clay residue during the sculpting process. A study found that fine particles enhanced plasticity, while coarse particles reduced it. Smoother sculpting and better cohesion were achieved with a higher percentage of fine particles. Understanding clay's drying and firing behaviour required knowledge of water absorption and shrinkage. Vieira et al.[54] suggest that clay that absorbs a lot of water may crack as it dries, while clay that absorbs little water may be difficult to work with. The chemical composition of the material determines how it behaves during firing and how it interacts with glazes and other surface treatments. It has been demonstrated that elements like silica (SiO2), alumina (Al2O3), iron oxides (Fe2O3), calcium oxide (CaO), and magnesium (MgO) affect the clay's workability, colour, and firing characteristics[72].

Besides, the aesthetic and conceptual values of using clay residue in environmental art were discovered by systematically experimenting with it and researching its particular characteristics. In the analysis, they learned that the inclusion of the clay residue made their work have a tactile and visual relief, thus creating an exciting relationship for audiences to interact with the works[10][45]. It was the addition of clay remains to land art that made the interaction with the landscape much more profound; coming straight from the earth, the material embedded humanity within the work. Such a combination further referred to sustainability and made it clear how important it is to recycle and reuse materials within the works, thus further vocalizing environmental care[18][8]. These above arguments make the findings of Asare et al.[11] tenable, having established that the incorporation of clay remnants into environmental art provided new frontiers for the researchers in terms of artistic expression and a channel to pass on meaningful messages about the human relation to nature. When processed suitably, clay residues showed their potential for the development of strong albeit purposely temporal constructions. The distinctive characteristics of the reclaimed clay resulted in unique textures and shapes, thereby motivating the emergence of innovative artistic styles that evoke organic, earth-inspired art[47]. The transient quality of the sculptures prompted artists to investigate

concepts related to impermanence, ecological cycles, and the connection between art and the natural environment. Furthermore, the method contributed to minimizing clay waste in landfills within the study region, illustrating notable environmental advantages[22].

In return, the different composition of the clay brought forth a very large palette of earth tones and textures that increased their aesthetic value tenfold. The kachcha imperfections forming in reused clay gave unique textural qualities that were hard to reproduce, therefore adding richness and character to the pieces themselves[21][4]. The plasticity of recycled clay made it possible to model various complex, organic shapes that will match their natural environment in harmony[44]. According to Davis[6], the process of recycling clay materials has become a powerful metaphor for renovation and change in the context of art, a realization that deeply moves people at emotional and mental levels as well[40]. The transitory nature of the sculptures sparked debates on the temporality of human creations in the face of natural forces and therefore nudged consideration of questions of ecological concerns[28]. Researchers observed a greater level of connectivity with their materials and the environment, and more purposeful and ecology-sensitive artistic research methodologies developed[18]. It established a connection between commercial waste and art, and therefore challenged existing perceptions of mediums and techniques for art-making.

4.2. Utilisation of clay residues affects contemporary artistic trends and methodologies

Clay waste brings about new excitement for material-driven art[49] as the characteristics of the medium are deeply related to the final form and concept. This was when a new aesthetic category came into force — one defined by unrefined textures, earthy colors, and shapes that intentionally present the origin of the material as well as its shortcomings[2]. Researchers used new approaches, making clay the most heterogeneous waste material that exists today, becoming more modular and able for problem-solving. This hypothesis is consistent with that due to Noce et al. Example, Oti et al., 2014[48] (2021) in their studies noted that site specificity in sculpture is a type of geographical local difference that has been articulated through the uses of indigenous clay wastes when artists make sculptures that concern directly where they are. The ephemerality of the statues has brought excessive focus on time-bound archival evidence and artistic processes, such as recording the process via time lapse when these are all, in fact, temporary structures[15]. Today, artists are using industrial by-products such as clay residues that were once deemed valueless ([73][7]) in efforts; creatives are increasingly motivated to source sustainable and eco-friendly alternatives in their creative process.

They were able to reduce their carbon footprint, but they also created very interesting recycling works that break the mould of conventional artistic practice by using waste from clay in their product. Certainly, the inclusion of clay waste into modern art expression also offered diversified avenues of enquiry and creation for Sampah et al., 2024[10]; Asamoah et al., 2022[8]. It is in this realm of a physically implausible imposition on material, which the researchers have navigated so easily, that we find the emergence of new sculptural techniques and processes. This has resulted in a cordial resurgence of interest in clay as a medium whereby artists push the limits of what is considered acceptable with this malleable material. "[2]. Additionally, in terms of art, the use of clay waste is a scathing commentary to rethink sustainability and reconsider our relationship with mother earth. Noce et al., 2021[7]. Environmental awareness of clay waste and adoption of sustainable community environmental projects by personal preservation movements[8]. The use of clay waste in art oriented to the present has influenced methods and procedures in art practices, resetting conventional approaches: it holds sustainability center stage with an ecological perspective[18].

4.3. Cultural and environmental repercussions of reimagining clay residues as artistic mediums

The cultural and environmental impacts of repurposing clay remnants as artistic materials were discovered to be significant. Repurposing clay remnants as artistic materials had cultural implications. The researchers were able to connect with traditional pottery-making practices and pay homage to the history and heritage of ceramics by incorporating clay residues into their work[47]. This process helped to preserve and promote cultural traditions, while also adding a unique and personal touch to their artwork. The artistic process has the potential to have a positive impact on both the environment and cultural heritage. It allowed the researchers to create beautiful and meaningful pieces while also promoting sustainability and preserving traditional practices[73].

The study initiated a cultural shift in perceiving industrial by-products, transforming "waste" into a valuable resource for creative expression. There has been a renewed interest in traditional clay-working techniques, particularly those that align with sustainable practices[44]. The study reduced clay waste in both ceramic and sculpture studios at TTU, demonstrating significant environmental benefits. Again, utilising local clay residues decreased the carbon footprint associated with sourcing and transporting new art materials[46]. The ephemeral nature of the clay sculptures ensured they naturally decompose, minimizing long-term environmental impact[7]. Some clay sculptures have shown potential for creating microhabitats for local flora and fauna as they degrade. There was a growing cultural acceptance and appreciation of transient art forms, aligning with natural cycles of decay and renewal. The site-specific nature of these clay sculptures enhanced the cultural identity of local landscapes, creating new landmarks and points of community pride, as indicated in Figure 1.

Figure 1. Ephemeral clay sculptures with different forms, textures, and shapes

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4.4. Audience responses

To effectively assess the impact and success of transforming clay residues into transient ceramic sculptures, it was imperative to gauge the audience's reactions. This diverse group comprised art educators, students, practicing artists, and the broader community, all of whom offered insightful feedback on the aesthetic, intellectual, and environmental facets of these creations. This input was amassed via a multitude of channels, such as surveys, interviews, and direct observation during exhibition showings. The public's interaction with these fleeting art pieces was particularly substantial, as evidenced by the surveys that pointed to a heightened consciousness regarding environmental matters and waste handling among the viewers[40]. Upon examining the feedback on these clay residue-based artworks, a spectrum of audience reactions was anticipated. These were organised into four main categories: aesthetic pleasure, emotional resonance, comprehension of the concept, and heightened environmental awareness.

4.4.1. Aesthetic Appreciation

Affirmative Responses:

Admiration of Craftsmanship: Some audiences expressed admiration for the skill and creativity involved in transforming waste materials into beautiful, intricate sculptures. Comments highlighted the textures, forms, and overall visual appeal of the artworks.

Response 1:

> *"The delicate textures and organic shapes are stunning. It's incredible that these pieces were once considered waste."*

Appreciation of Innovation: Some viewers praised the innovative use of materials, seeing the sculptures as a fresh and creative approach to traditional ceramics.

Response 2:

> *"This is a brilliant way to push the boundaries of what ceramic art can be. It's both modern and deeply connected to the earth."*

Constructive Criticism:

Suggestions for Enhancement: Some audience members suggested ways to enhance the aesthetic appeal, such as incorporating more vibrant colors or combining clay residues with other materials.

Response 3:

> *"The natural tones are beautiful, but it would be interesting to see how a splash of colour might change the dynamics of the piece."*

4.4.2. Emotional Impact

Affirmative Responses:

Connection to Nature: Some audiences expressed a deep emotional connection to the sculptures, especially if they evoke natural forms or landscapes. This process elicits feelings of nostalgia, peace, or reverence for nature.

Response 4:

> *"These sculptures remind me of the landscapes of my childhood—there's something very peaceful and grounding about them."*

Sense of Ephemerality: The transient nature of the sculptures evokes reflections on the passage of time, the impermanence of life, or the beauty of decay.

Response 5:

"Knowing these pieces won't last forever makes them even more precious. It's a poignant reminder of life's fleeting beauty."

Mixed Responses:

Melancholy or Loss: Some viewers might feel a sense of melancholy or sadness at the idea that the sculptures will eventually degrade, leading to reflections on loss and impermanence.

Response 6:

"There's a sadness in knowing these sculptures will eventually fade away, but perhaps that's what makes them so powerful."

Response 7:

"It makes me appreciate this moment more, knowing that this sculpture will soon return to the earth. There's something profound about witnessing art that embraces its own impermanence."

Response 8:

"I'm used to thinking of art as something you can own or keep, but this makes me realize that art doesn't have to be permanent to be meaningful. It feels like a critique of consumer culture."

Response 9:

"Watching this sculpture slowly break down over time reminds me of the natural cycles we're part of. It's a powerful reminder that everything is constantly changing, and that's okay."

4.4.3. Conceptual Understanding

Affirmative Responses:

Grasp of Environmental Themes: Some audiences express a clear understanding and appreciation of the environmental messages embedded in the artworks, recognizing the importance of sustainability and waste reduction.

Response 10:

"I love how these sculptures make you think about waste in a new way. It's a brilliant commentary on sustainability and the art of reuse."

Interpretations of Symbolism: Viewers offer interpretations of the symbolic meanings in the sculptures, relating them to broader themes such as regeneration, the cycle of life, or the intersection of nature and human creativity.

Response 11:

"The way these forms blend with the natural environment speaks to the interconnectedness of all things. It's a beautiful metaphor for life."

Challenges in Understanding:

Complexity of Concepts: Some audiences find the concepts behind the artworks challenging to grasp, especially if they are unfamiliar with the themes of sustainability or ephemeral art.

Response 12:

"I'm not sure I fully understand the idea behind using residues—why not just use fresh clay?"

4.4.4. Environmental Consciousness

Affirmative Responses:

Increased Awareness: The artworks inspire viewers to reflect on their own environmental impact and consider how they can incorporate sustainable practices into their lives.

Response 13:

> *"Seeing how something as simple as clay residues can be turned into art makes me think about how much we waste every day. I'm inspired to be more mindful."*

Support for Sustainable Art: Some audiences express strong support for the use of sustainable materials in art, seeing it as a necessary evolution in artistic practice.

Response 14:

> *"This kind of art is exactly what we need today—beautiful, thought-provoking, and good for the planet."*

Skepticism or Critique:

Practicality Concerns: There was skepticism about the practicality of using residues for art on a larger scale, with some questioning whether this approach can truly make a significant environmental impact.

Response 15:

> *"It's a great idea, but I wonder if this can really make a difference in the long run. What about the energy used in other parts of the process?"*

5. Discussion

Beyond the specific properties of clay residues, the main takeaway was that this ephemeral artistic practice was an opportunity to explore waste as a resource. This view is compatible with Material Engagement Theory, which underlines the mutual influence between materials and acts of creation[31][32][33]. The research showed that waste materials, clay residues — usually dismissed as valuable by-products — could be recycled and up-cycled to create artefacts of fulfilment, purpose, and beauty. This transformation unsettles some of the long-held conventions of material hierarchy in art, where new or unadulterated materials have often been privileged over cast-offs and refuse. The study does not only cut waste but also flexes the muscles of artistry as it includes the residuary in an artform[8]. To add an extra dimension of intrigue, the sculptures were ephemeral. These were not designed to endure by comparison with the age-old objectives of making works of art last forever. It was as if their evanescent nature encouraged us too, the audience, to consider transience— itself a reflection of the ebb and flow – of growth, decay, and rebirth – that is so central to everything natural... This seems to ask us and the artists and those who came after us why exactly we are valuing art so concretely, making out a reminder of the transient realm it sought to portray[13], and that its true essence lies much deeper within it?

Audience responses to the ephemeral sculptures were varied, reflecting diverse perspectives on aesthetics, emotional impact, and conceptual understanding. Many viewers appreciated the craftsmanship and innovation involved in using clay residues, with some expressing a strong emotional connection to the natural forms and textures that the sculptures evoked. This positive reception highlighted the potential for such works to resonate with audiences on both an aesthetic and emotional level[40]. However, the ephemeral nature of the sculptures also elicited mixed emotions. While some viewers found beauty in the transience of the works, others experienced a sense of melancholy or loss, stressing the complex emotional responses that ephemeral art motivated[23]. This range of reactions emphasizes the importance of considering audience perceptions in the creation of such works, as the emotional and conceptual impact varied widely depending

on individual interpretations. The conceptual understanding of the artworks also varied. While many audience members grasped the environmental themes and appreciated the symbolic use of residues, others found the concepts challenging, particularly if they were unfamiliar with sustainable art practices[18]. This suggested a need for more educational components in exhibitions to help bridge the gap between the artist's intentions and the audience's interpretations, ensuring that the environmental message is communicated effectively.

One of the central aims of this study was to explore how artistic practices contribute to sustainability by repurposing waste materials. The use of clay residues in the sculptures served as a practical example of how art addresses environmental concerns, transforming waste into beauty and inciting reflection on consumption and wastefulness[8]. This aligns with broader trends in eco-art and sustainable art practices, where artists are increasingly using their work to comment on environmental issues and promote sustainable living[70]. However, the study also highlighted some challenges in achieving true sustainability in art. For instance, while the use of residues reduces waste, other aspects of the artistic process, such as the energy required for firing clay, still have environmental impacts. This raises important questions about the balance between artistic innovation and environmental responsibility. The study revealed that while the use of residues is a step in the right direction, a holistic approach to sustainability in art considers all stages of the creative process, from material sourcing to final production[7].

6. Implications for Future Artistic Practices

The findings of this study have several implications for future artistic practices, particularly in the context of sustainable art. Firstly, the success of using clay residues as a material suggests that other forms of industrial or post-consumer waste could be similarly repurposed, opening up new possibilities for creative expression[10][8]. Artists and educators are encouraged to explore these possibilities, fostering a culture of innovation that prioritizes sustainability.

Secondly, the varied audience responses highlight the need for artists to engage with their audiences more deeply, perhaps through interactive elements or educational programs that help explain the concepts behind the work[18]. This could enhance the audience's appreciation of the environmental themes and ensure that the message of sustainability is effectively communicated.

Lastly, the ephemeral nature of the sculptures suggests a shift in how art is valued. Moving away from the traditional focus on permanence, artists can explore the beauty and significance of transient works, encouraging audiences to embrace the impermanence of life and the natural world[13][23]. This approach not only reflects ecological realities but also offers a powerful commentary on the temporality of human existence.

7. Conclusion

The study on repurposing clay residues into ephemeral ceramic sculptures has provided significant insights into the intersection of sustainability, artistic innovation, and audience engagement within the realm of contemporary art. By transforming what is often regarded as waste material into meaningful and aesthetically compelling artworks, this research challenges conventional notions of material value and permanence in art. The ephemeral nature of the sculptures highlights the beauty and significance of impermanence, aligning with natural cycles and inviting deeper reflections on environmental stewardship. Key findings from the study highlight the potential of sustainable art practices to promote both creative expression and environmental consciousness. The use of clay residues not only reduces waste but also opens up new avenues for artistic exploration, where the material itself plays a critical role in shaping the narrative and emotional impact of the work. This approach is particularly relevant in

the context of Material Engagement Theory (MET), which emphasizes the dynamic relationship between materials and the creative process, demonstrating how materials can actively contribute to the meaning and reception of art.

Audience responses, while varied, generally reflected a strong appreciation for the craftsmanship and innovation involved in the creation of the sculptures. The artworks elicited a wide range of emotional and intellectual responses, from admiration for their aesthetic qualities to reflections on the broader themes of sustainability and the ephemeral nature of life. However, the study also revealed challenges in communicating complex environmental concepts to a diverse audience, suggesting the need for more educational outreach and interpretive support in future exhibitions.

Statements and Declarations

Ethics

The study involving human participants was reviewed and approved by the University's Ethics Committee (Takoradi Technical University (TTU) Research Ethics Committee-TTUERC). The participants provided their written informed consent to participate in this study.

Data Availability

The datasets generated for this study are available on request to the corresponding author. The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, subject to privacy and ethical restrictions.

Author Contributions

EKD: Conceptualization, Methodology, Investigation, Writing – Original Draft, Writing – Review & Editing. FB-Y: Methodology, Investigation, Writing – Review & Editing. O-AA: Investigation, Writing – Review & Editing. VKB M: Supervision, Writing – Review & Editing.

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