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CERAMIC TOOLS, EQUIPMENT, AND MATERIAL HANDLING: SAFETY GUIDE FOR EDUCATIONAL STUDIOS AND WORKSHOPS

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Abstract
As ceramic studios and workshops become more widely used in educational settings and also grow in both tourist and income generation, it is clear that more can be done to create a safer and healthier work environment. Translating this into ceramics, which is both an artistic medium as well as an environmental and materials-based setting, this study presents the issues of health, safety, and welfare that face both professionals and students working with ceramics - a true paradox of dangerous equipment and hazardous material but with artistic appeal. The focus of this research is to investigate current safety legislation and procedures in educational studios/workshops to create a health and safety guide, accounting for both serious and minor health and safety risks, for use in ceramics. Using secondary data, the study provides a literature review on existing safety protocols and hazards related to the use of ceramic equipment and the handling of ceramic materials. This lack of added protection highlights the problems with existing safety standards and the need for individualized safety recommendations that can be mechanical, thermal, chemical, and ergonomic. This guidance is important as the study outlines the precautions needed to be aware of when handling and storing ceramic pieces and glazes, kiln and other machinery operation, and the need for PPE, ventilation systems, and ergonomic practices. Through this research, the aim is to create awareness and promote a culture of safety in ceramic studios and workshops to ensure a safe and productive environment for instructors and students alike.

Keywords: Material Handling, Studios, workshop, Ceramics, Education, Silicosis, Safety Guide, Artificial Intelligence.

Introduction

Educational Studios and Workshops are such settings where practitioners, students, and teachers have access to a range of tools, materials, and technologies to work on practical projects and collaborations. Educational studios promote flexible learning environments that respond to different modalities of learning, broadening learning styles, and improving critical thinking that engages in problem-solving capabilities (Yu, 2024). Experimental spaces such as studios and workshops have been shown to significantly enhance student engagement and knowledge retention of students (Song & Cai, 2024**).** Thousands of educational studios and workshops are springing up that encourage creativity, collaboration, and interdisciplinary learning. They combine different fields such as art, science, technology, and design, encouraging participants to think across disciplines. These studio environments can lead to new career paths or innovative/groundbreaking solutions, according to Porter (2016), such as artistic practices meeting technology in workshops. In such collaborative spaces, teachers also foster community and support, which can make individuals feel safe to take risks and play with their ideas.

Creativity enhances artistic expression, as with technological development in ceramic studios or workshops. Clay allows for unique and one-of-a-kind creations that explore some form, gesture, and material combinations. Studios serve as temples of creative zeal where artists can freely conceive and develop their ideas on their terms and at their own pace **(**Burton et al., 2000; Eisner, 2000**)**. As artists explore and break through their medium, personally and collectively, the activity drives both individual growth and advances in the ceramic greater community. Ceramic studio creativity means not only personal expressing creativity but also sharing ideas and collaboration. The discussions give room for interactions where the individuals can learn from one another and drive inspiring ways of doing things going forward.

The cross-pollination of ideas in the studio can produce new methods that can create novel trends in the craft. An example could be an artist who, mixing traditional processes with contemporary influences, creates hybrid styles that raise questions about the definitions of ceramics, and in return expands the field (Nwigwe et al., 2024) And as with art, ceramics are made through a problem-solving process; it is not uncommon for artists to struggle and have to critically reflect and make strategic adjustments. Whether devoted to technical matters - glaze application, fire regimens, and those everyday workhorse clay bodies - or purely intellectual speculation, these experiments promote persistence and a closer engagement with the material. This process-oriented approach not only shapes the artist's skills and finished works; it also highlights the fact that creativity is a non-linear process, with each artwork being a link in a chain of artistic development.

The rationale for the study would be discussed, with the most prominent reasons being the relevance of making sure that educational environments where ceramics are taught or created under the guidance of an expert are safe. A gap in the literature on ceramic studios and workshops was their lack of a comprehensive safety guide. None of the referenced studies focused specifically on these settings, nor did they address the multifaceted nature of health and safety issues that can arise in ceramic studios and other academic location workshops. First, ceramics as an art form employs many tools, equipment, and materials that can be dangerous to students and teachers if not handled and understood properly (Ojie-Ogwu, 2013; Ebeigbe & Ikeneri, 2011). Such hazards include harmful dust exposure, misuse of kilns, as well as cuts while handling sharp tools. Hence, a critical guide of best practices on safety is necessary to prevent these hazards based on the assumption of a healthy and safe learning environment

The paper also notes that learning takes place in a novel educational environment with students of different ages and at different proficiency levels. A broad range of comprehension levels and physical abilities among this diversity necessitates bespoke safety protocols. The guide seeks to be widely applicable and effective by creating an inclusive user base. Moreover, the study aims to give educators the knowledge and tools they need to get their students practicing best practices in safety. Everybody who plays a role in such a learning environment that significantly impacts students' perceptions towards safety, and this guide is here to help educators fulfill this responsibility. Moreover, the study makes a noteworthy contribution toward ensuring that accidents and health concerns associated with ceramics are minimized through a culture of safety in ceramic studios or workshops in educational institutions. To improve the safety of creative and educational spaces for immediate users, and to serve as a role model for common safety standards for future generations.

Ceramic art and craft represent a unique intersection of artistic expression and hands-on expertise, which is made possible by a remarkably wide selection of instrumentation, tools, and materials. Due to the risky processes involved with ceramic processes, those within the educational studios and workshops must be safe. Ceramics is both an art and a science that requires substantial skill and patience to master, but it ultimately still involves a risky process with many hazards involved. Recognizing these hazards and implementing comprehensive safety precautions is critical to ensuring that everyone who interacts with ceramic (whether with the equipment, tools, or materials) is properly protected. To mitigate these hazards, it's crucial to adopt proper safety practices for safe handling within the educational environment, as these practices will transcend after completion of their educational career towards self-sufficiency by setting up their studio for entrepreneurial purposes (Ojie-Ogwu, 2016).

The field of ceramics is deeply rooted in the evolution of humankind (Hawley, 2018). Various practical functions, technical uses, and conceptual achievements form an underlying influence on both practice and interpretation (Raby, 2015). Archaeological excavation of ancient civilizations has found ceramics to be a prevalent practice across vastly different cultures, separated by time and space. As such, it forms an expressive, expensive, and expansive traditional technology and art form reaching as far back as 37,000 BCE (Raby, 2015; Maniatis, 2009). The materiality of clay is unique, its use for both functional and symbolic objects; its metaphoric qualities have assimilated it with creation myth in various religious and social contexts (Ozidede, 2024; Livingstone and Petrie, 2017; Ojie, 1993).

Ceramics can be described as a non-metallic solid substance, made up of either metals or non-metal compounds that have been heated and cooled (Mishra et al., 2023). Ceramics are generally hard, corrosion-resistant, and brittle after passing through various thermal treatments. The demand for ceramics in the world is what has led to the development of pottery-ceramics centers, studios, educational research institutions, and industries, thus being able to meet the demands of its goods and services (Curious Mind, 2023).

Even today, ceramics are interwoven into our everyday lives, performing many household functions as vessel materials, containers for food, bricks, and tiles for shelter. In addition, it also serves various industrial functions, such as electrical insulation, cladding spaces for shuttles, and advanced applications in medicine (Matizamhuka, 2019). Through its transformative abilities, its persistence, and intimate connection with daily lives, ceramics gains its power as an artistic medium, fulfilling dynamic artistic roles as a vehicle for exploration of material culture. It is this persuasive ability of clay and its transformation into ceramic forms and shapes for creative practice that has made it possible for use by the ancients to the present-day modern humankind (Livingstone & Petrie, 2017; Curious Minds, 2023).

Educational studios and workshops ready with ceramic equipment, tools, and raw materials without proper measures may be exposed to the risk of injury and health hazards involved in the process between preparing materials and manipulating forms for their desired work. Many people have played with and made things with the materials related to ceramics from early childhood. It is challenging for them to imagine that these materials that have enabled them to produce objects while providing creative efforts can be harmful to their health. These risks are exposure to dangerous dust, unsafe operation of machinery without the right safety measures, and ergonomic problems due to incorrect manual handling of materials, to name just a few.

This is intended to highlight the necessity of crafting a specialized safety guide that is tailored to the interests of ceramic studios and workshops in school settings, that addresses and helps in avoiding these dangers and risks involved in working with ceramics and clay. Artists must recognize studio hazards and how to protect themselves and the people working around them. The following specific objectives of the study are to:

1. Evaluate the safe operating procedures associated with ceramics equipment, tools, and materials in educational studios and workshops.
2. Find out about potential hazards and dangers of using ceramic instruments and tools, and handling materials used in educational settings.
3. Protect, as well as assess the credibility of current safety procedures and measures within educational studios and workshops.
4. Recommendations for improving safety standards and procedures for the use of ceramic equipment and materials in educational environments.
5. Educate on best practices for the safety of students and instructors working with ceramic equipment and material.

The research relies totally on secondary data collection. Secondary data was drawn from various sources, which have been duly acknowledged and referenced. The secondary data involves gathering Information on occupational health and safety concepts and various issues related to health and safety in ceramic studios and other educational workshops. This gathered information was obtained by consulting the websites, journals, books, periodicals, and reports from various government and non-governmental agencies. The research further took a qualitative turn by using the descriptive research method. The method is used in describing the implications of health and safety of ceramic professionals and how it affects their social, mental, and psychological well-being when working with hazardous ceramic equipment and materials.

Basic Ceramic Tools, Equipment, and Materials Found in the Educational Environment

Ceramic art has emerged as a fundamental element in numerous educational workshops and studios in Nigeria and globally. A list of fundamental ceramic equipment, tools, and materials commonly found in a standard ceramic studio is presented below:

i. ***Pottery Wheels***: Pottery wheels are instruments utilized for forming clay into symmetrical objects such as bowls, vases, and mugs. Electric and kick-wheel formats are available, enabling artists to produce various types of pieces according to their preferences (Ojie-Ogwu & Egede, 2009; Bazunu & Odokuma, 2008).

ii. ***Kilns***: Kilns are essential for firing pottery at elevated temperatures, transforming the clay into completed items. Various types of kilns include electric, gas, wood-fired (Atuh & Ozidede, 2023; Ozidede, 2024; 2017), and at different sizes.

Figure 1: Electric Pottery Wheel
Source: https://www.theceramicshop.com/store/

Figure 2: Multiple-fueled liquid burner Kilns.
Source: Delta State University, Abraka.

Kilns have been used throughout the ages by prehistoric people to modern-day civilization to subject ceramic objects to varied temperatures. In ancient times and also in today's modern-day society, born fire or pit firing was utilized before the advent of the kiln (Agumba & Abbott, 1996). The firing method consisted of heaping the pots untop one another in a properly arranged manner alongside stuffing with sawdust (Ojie &

Egede, 2010; Abamwa, 2002). After this process is completed, straws and small wood are arranged by the side of the stuffed pot to create an open fire. Similarly, in the pit firing, a small pit is dug, sawdust alongside other combustible materials, with the wares to be fired. This operation is usually done during the dry season. The application of heat to ceramic wares is as important as DNA in a human body. Kilns are designed to house heat, and it is one of the most expensive equipment and most energy-intensive. According to Ozidede, (2017), Institutions usually use periodic kilns because the kilns are used periodically, and their operation often involves a downdraft or an updraft kiln; while industries are required to work with continuous kilns due to their continuous nature of firing. Kilns have been designed to accommodate different fuels for firing, while some have been modified to utilize multiple fuels for combustion.

iii. ***Ball Mill***: Ball mills are essential in the manufacturing of ceramic wares. They are extensively utilized in manufacturing and are deemed second of the second most essential after the kiln in modern-day ceramic manufacturing. It provides a flexible and effective approach for material preparation that directly influences the quality and attributes of ceramic products (Ozidede & Ofili, 2024; Sherma et al., 2015; Heim et al., 2005). This setup facilitates particle size reduction by impact and attrition as the balls drop from near the top of the shell and cascade with the materials in the mill. According to Ozidede & Ofili (2024), ball mills can mix different materials and can achieve the needed physical and chemical composition and properties when the right ratio of materials (the substance) and the grinding materials is in proportion. The consistency of the final product can be directly influenced by the milling process and time, which ensures that the final product's structural integrity and aesthetic appearance are adequate for use after passing through proper milling to attain the right particle size. Also, water can be added to the ceramic material through the ball mill cavity to the right proportion, following the size of the chamber and the grinding material to form a paste either for glaze preparation or clay body slurry for casting (industrial reproduction with the use of Plaster of Paris – POP). Different types of ball mills suffice for different operations.

Figure 3a & b: Porcelain Pebbles of different sizes and Ball Mill (Ozidede & Ofili, 2024).

A hollow cylinder that revolves around its axis is the component that makes up a ball mill. The axis might be horizontal or at an angle to the horizontal, depending on the use of the ball mill. For grinding, the cylinder is partially filled with balls, which serve as the grinding media. Rubber, steel (such as chrome steel), ceramic (such as flints or porcelain pebbles), or stainless steel are some of the materials that can be used to make these ball mills and ball constructions. The inner surface of the cylinder is lined with an abrasion-resistant material such as manganese steel or rubber at regular intervals, which results in a reduction in wear in mills that are lined with rubber (Ozidede & Ofili, 2024). The materials that are going to be ground are introduced into a ball mill through the hole that is located at the very top of the cylinder. It is also possible to charge balls into the cylinder, which is then closed and rotated. This gives the balls the ability to crush materials as they move through the cylindrical structure.

Figure 3c: Cascading effects of balls in a ball mill (**source:** http://en.m.wikipedia.org**)**

According to Longhurst (2010), if we do not have the balls installed in the cylinder or some other medium to crush the materials that we want to grind, then there will be very little or no grinding that takes place. The balls are hoisted onto the rising side of the shell as the cylinder rotates, and then they cascade down (or drop down on the feed) from near the top of the cylinder. This causes the solid particles that are between the balls and the ground to be reduced by collision.

iv. ***Clay***: Clay is one of the most significant components of ceramics manufacture at any level. The type of clay available to ceramics has a vital role in determining the type of wares produced, whether porcelain, earthenware, or stoneware. Each clay and clay body has distinct qualities that influence the ultimate product's color, texture, and durability. Ceramics are made feasible by clay, a very common but distinctive material. Nelson (1983) suggests that clay should not be confused with soil, which is a mixture of clay, sand, humus (partially decaying vegetable), and a variety of other components when compared to other earth materials.

Clay is a fascinating substance that is flexible and sticky, making it an ideal medium for a ceramicist and another clay enthusiast. Clay's ability to stick is known as plasticity, and remains its greatest virtue (Otimeyin 2015). Aside from being soft and flexible, which allows the fingers to respond to its plasticity in the hands, clay is delicate when dried and can easily crumble. Igbinedion (1995) defines clay as a natural material found in the earth's crust or rocks that exhibits flexibility when exposed to a suitable amount of water. This water allows the clay to be easily shaped into any desired shape while moist. After heating, the clay becomes a permanent substance that can retain its original shape for thousands of years (Ojie-Ogwu & Ozidede, 2021; Speight & Toki, 2003); enabling the artists or potter to communicate with past civilizations and explore the vast reaches of space (Hawley, 2018).

v. ***Glaze:*** A glassy surface mixture used to cover ceramic objects for aesthetics and to make them resistant to water and stains. From a chemical point of view, glazes are made from silica, fluxes, and alumina, which create a sturdy surface after they are fired in a kiln (Otimeyin, 2015; Ojie & Egede, 2002). Firing takes place, turning that powdered glaze into a glossy surface, sealing the body of the ceramic. Aside from helping enhance the representation of the work through its colors and textures, glaze also affects how long the work will last and whether it can be used, so it is integral to both works of art and more utilitarian pieces.

Ebeigbe, (2011) states that different types of glazes, such as glossy, matte, transparent, and opaque, act in various artistic and useful ways. Glossy glazes, for instance, ease light reflection and intensify colors, making them a favored choice for decorative objects, while matte glazes give a more subtle, mellow effect. In contrast, Transparent glazes show the clay body or decoration underneath them, while opaque glazes completely cover the substrate, providing a solid color. Glazes can be applied using various techniques, including dipping, brushing, or spraying; the technique used will ultimately influence the outcome (Ojie & Egede, 2002). This vocabulary of global color alone, in application methods (engobe, glaze) and effects (artist pigments) can shape even more effectively the result of ceramic pieces, yet still enable the artist to express creativity and determine the utility of the piece.

vi. ***Workbench and Workspace***: A studio's worktable and workspace are essential components since they promote efficiency and safety while facilitating the creative process (Sicotte et al., 2019; Suckley & Nicholson, 2018). The workbench may contain any equipment and supplies needed for pottery. The worktable is a specific area used for molding, sculpting, and finishing clay products, mixing glaze test batches, as well as other important activities in the studio or workshop. Bear in mind that the workspace, which will include hand-building areas, wheel throwing and glazing areas, is important for making full use of a session and reducing potential safety hazards. A space large enough to move around in and for tools to be stored decreases the chance of accidents occurring and allows for a more conducive learning environment for students.

vii. ***Tools for Sculpting***: In a ceramic studio, sculpting tools are of primary importance, as they allow artists to perfectly shape and smooth their work after creation (Taylor, 2011). Such tools often include wire cutters, loop tools, rib tools, and carving instruments used for various purposes, including trimming and smoothing or adding a texture to the clay. Wire cutters are excellent for cutting through large blocks of clay, and loop tools enable the removal of excess material and the formation of finer details. Rib tools are an important tool for creating smooth surfaces and shaping forms, so they are essential to both hand-building and wheel-throwing techniques (Otimeyin, 2015; Speight & Toki, 2003). Moreover, there are different types of carving instruments available in different sizes, which help to create intricate patterns on the sculptures. Understanding these tools in detail helps the sculptor not just in the expression but also in making the process very efficient and safe, ensuring that the sculptor performs with skills in the studio.

viii. Safety Equipment: Personal protective safety equipment in the ceramic studio is required for protecting artists or students from any unexpected injuries while working with clay, glazes, and tools. PPE such as dust masks, gloves, and safety goggles reduces exposure to dangerous materials like silica dust and toxic chemicals contained in certain glazes (Ceramic Art Network, 2024). In addition, aprons help to keep clothing clean from spills and stains, and proper ventilation systems, according to Peterson (1996), can reduce the risk of inhaling fumes released when firing or toxic gas from glazing. Ensuring safety equipment is readily available and used helps to ensure a safe working environment, safe practices, and a better, more comprehensive learning environment for ceramic studios, other studio practitioners, and staff.

Context of Workplace Hazards

1. Thermal Hazards: Thermal hazards are common when working with materials that produce hot surfaces, like kiln walls, or using equipment that has open flames, like burners. The use of ceramic equipment and tools, especially those used in kiln operations, leads individuals to experience high thermal hazards (Ojie-Ogwu & Ozidede, 2021; Ozidede, 2017). The process of working with ceramics - molding, shaping, and firing the material to complete it - comes with built-in risks, given the high temperatures involved. As such, it is critical to understand and prevent such thermal dangers for workplace safety. First of all, kilns burn at very high temperatures, often above 1,200 ° Celsius, depending on the type of clay body. Leading to severe burns on the direct or, even from indirect contact with such temperature or heat. Similarly, when people load or unload the kiln, there is a risk of a thermal burn if the kiln is not given sufficient time to cool down before unloading.

As a result, it is important to keep a safe distance from the kiln when it is in use and to provide suitable barriers or shielding for radiant heat (Atuh & Ozidede, 2023). Use safety equipment when handling hot ceramics or kiln furniture, and this includes the use of face shields and heat-resistant gloves. Another useful thing to do, to minimize the chances of burns, is to establish a protocol that enables the kiln and its contents to cool enough that it can be opened safely. Harm done to the people handling hot kilns through thermal shock should be considered a risk that cannot be understated. Extreme temperature changes, like transferring a piece from one point to another point create a significantly new design during Raku firing and operation. Such an operation can create cracks in the material and drop onto your body or, even worse, explode on your face and hands (Scottish Potters Association (SPA), 2021). Apart from threatening the ceramic wares of statues themselves, this risk of emitting razor-sharp shards should not be taken for granted. Finally, specific tools and equipment used in the shaping and finishing of ceramics, such as hot wax tools or heated drying equipment, also pose thermal hazards. Taking precautions such as using these tools in a well-ventilated space away from heat-sensitive surfaces directed by the manufacturer, can reduce these risks. A crucial way to understand ceramics is that you must know how to handle and transfer ceramic objects.

2. Mechanical hazard: Mechanical hazards mainly come from operating a wide range of equipment and tools, which can cause risks if not used properly or if appropriate safety protocols aren't followed to verify the safety of those working in a ceramic studio. Mechanical hazards in ceramic studio practice may be:

i Sharp Edges and Points: Trimming tools, needles, and wire cutters are just some of the ceramic tools that can have sharp edges or points that can easily cause cuts or punctures if misused.

ii. Rotating Machinery: Potter's wheels, pug mills, and similar equipment, rotating parts that have entanglement hazards. Hair, clothes, or jewelry can get caught in these components and are known to cause serious injury.

iii. Crushing and Pinching: Heavy machinery that is used for pressing or extruding the clay can cause crushing hazards. Rotating angular blades with equipment like pug mills and corn milling equipment is an excellent example. Fingers, hands, or limbs can be caught between the moving angular blades, resulting in serious injuries.

iv. Flying Debris: Many processes, for example, trimming, cutting unfired clay, and sanding the surface of ceramic ware, can produce chips and debris that can fly off and injure your eyes or cause minor cuts. Eye protection and nose masks must be regarded as essential commodities to minimize dust inhalation and to keep debris away from the eyes.

v. Noise exposure: Significant noise-generating equipment (gas and oil kilns, burners, mixers, air compressors, construction equipment, etc.) can expose individuals to excessive noise levels, which, without proper hearing safety, can potentially result in hearing damage over time.

3. Chemical hazards: Some chemical hazards may exist when working with ceramic materials. Health hazards associated with ceramics are mainly related to the materials and methods used, such as raw materials, including glazes, and the firing process.

i. Dust and Inhalation Hazards: Silicosis disease is one of the major ailments faced by ceramists (Kurtul et al., 2021). Numerous raw materials employed in ceramics, including silica, talc, and other various types of clay and ceramic materials, have the potential to create dust that, when inhaled, can present significant health risks. Silica dust, for instance, when inhaled for a long time, can cause silicosis, a debilitating or deadly lung disease (Sakar et al, 2005; Britannica Encyclopedia, 1998).

ii. Toxic substances: Several materials used in glazes and decorations, like lead, barium, cadmium, chromium, and manganese, are a few examples (Taylor, 2011; Peterson, 1996; Kirkpatrick, 1978). These materials can be dangerous if swallowed or if their vapors are inhaled while firing. (In particular, you need to use lead-free or low-lead glazes for items that will be used to hold food and make sure there is good ventilation when firing your pieces.)

iii. Chemical Reactions: During firing, chemical reactions take place, which could discharge some hazardous gases to the atmosphere. These poisonous fumes can include carbon monoxide, sulfur dioxide, and multiple nitrogen oxides (Scottish Potters Association (SPA), 2021). These gases can be hazardous if inhaled, requiring that kiln areas be adequately ventilated

iv. Skin Contact: Direct exposure to certain chemicals and raw materials may cause skin irritation or more serious dermatitis. Wear protective gloves and clothing to reduce skin exposure.

4. Ergonomic Hazards: Ergonomic hazards are workplace conditions that have the potential of causing injury to a person's musculoskeletal system when using ceramic equipment and tools over time (Ceramic Art Network, 2024; Johnston & Lipscomb, 2006), and these hazards may include:

i. Repetitive Motion: Tasks such as wedging clay are repetitive, and ultimately cause strain and injuries in the wrist (i.e., over time). Modernity has also made pathways for such work, and equipment has likewise been engineered to ease some of the ergonomic load. Equipment such as the pug mill has been dedicated to such an operation.

ii. workstation height: Working at tables or equipment that are too high or too low can put the body in poor positions, straining the back, shoulders, and neck.

iii. Heavy Lifting: Without proper lifting techniques, heavy bags of clay or large pieces of ceramics can fall or hurt your back.

iv. Poor Tool Design Using tools that do not rest comfortably in the hand or that require too much force for repetitive action can result in hand and wrist injuries and damage, such as carpal tunnel syndrome.

v. Static Postures: Prolonged sitting in the same position, such as being at the potter's wheel, can lead to discomfort and musculoskeletal disorders (Melzer, 2010).

To counteract these ergonomic hazards, one must ensure that workspaces are properly tailored to suit individuals working in the studio. The studio should be equipped with adjustable equipment, simple tool design, and tool use. Also, regular breaks from the studio or workshop should be practiced to encourage stretching the body, changing posture, and training in proper lifting techniques after working.

Material Handling in Educational Workshops and Studios

Safe space procedures for material handling in educational workshops are important, as these studios and workshops often involve tools, machinery, and materials that can be risky if used incorrectly. Several key components involve a safe space, as explained below:

i. Safety Briefing and Training for Staff and Students: As part of pre-workshop orientation, a detailed safety briefing must be given to students and staff, and safety instructions relayed to them to avoid the various hazards referred to above (Osinubi et al., 2017). This includes how to use studio equipment safely, the necessity of using personal protective equipment (PPE), and the management of any hazards in the event of an emergency.

ii. Clear Signage and Instructions: Signage should be easily visible in studios and workshops, including safety procedures, first aid kits, usage, and emergency exits. Operating instructions for machinery and tools should be visible as well.

iii. Physical Precautionary Measures: Set up the workshop in a way to minimize risks. This includes making sure there is adequate space around equipment and does not cause crowding, and making sure pathways to emergency exits are clear. The studio technician or the workshop instructor also needs to ensure that routine maintenance checks are performed on the equipment so that they are in good working condition.

iv. Mental and Emotional Sense of Safety: Creating a supportive and inclusive environment is crucial. It includes creating an environment where questions are welcome, mistakes are growth opportunities, and harassment or bullying are not tolerated in the studio environment (Sutas, 2022).

vi. Emergency Preparedness: Students should be aware of the procedures and protocol for using the studio or workshop, including information on how to use a fire extinguisher in the event of a fire outbreak, where to recover in the event of an evacuation, and contact information in the event of an injury.

vii. Supervision and Support: A Qualified individual should always be present at all times to supervise students using the studio; they should be ready to provide guidance and ensure that safety protocols are followed. By implementing these safe space procedures, educational outfits can provide a secure environment that encourages learning and creativity while minimizing the risk of accidents or harm.

Developing a Safety Training Program

Developing a safety training program for educational studios and workshops that focus on ceramic equipment, tools, and material handling is crucial to ensuring the safety and well-being of students and staff. These structured approaches could enhance an effective safety training program:

i. Safety Risks Assessments: Make the proper assessment of the studio or workshop to reduce safety risks regarding the ceramics equipment, tools, and material handling. That can involve hazards from kilns, pottery wheels, glazes, and other materials.

ii. Formulating Safety Precautions: Based on the hazards recognized, devise definitive safety measures. This includes information on proper use of equipment, requirements for use of personal protective equipment (PPE), and proper procedures for handling material as well as actions to take in the event of an emergency.

iii. Develop Training Content: Write up the content needed to train on all the areas of safety associated to the studio or workshop This includes proper functioning of ceramic equipment, the right way of handling and storing materials, consistent use of PPE, first aid, how to handle an accident, and fire safety, particularly with kilns.

iv. Organize Interactive Training Sessions: Different participants are being engaged in the different sessions. Limitations of teaching methods: Use a combination of presentations, demonstrations, and hands-on practice to ensure participants have a thorough understanding of safety procedures. Add tests to check that students understand (Osinubi et al., 2017).

v. Plan Regular Refresher Courses: Safety training is not a one-time deal; it involves several hands-on experiences. It is pertinent to organize regular refresher courses to update everyone on safety protocols and to familiarize staff, studio practitioners, and clay hobbyists with any new standards or equipment as needed

vi. Write or Revisit Safety Manual: Put together a safety manual containing all safety protocols, guidelines, and procedures. This manual should be available to all students and staff in the studio or workshop

vii. Create a Safety Culture: Make safety a shared responsibility. Encourage open dialogue about safety issues and make sure everyone knows that they can speak up about unsafe conditions or behavior. To create a solid safety training program that each educational studio and workshop may follow to ensure the safety of everyone involved while allowing them the best possible opportunity for learning, creativity, and exploration.

Review of Safety Standards and Regulations

In revisiting today´s safety standards and regulations, ensure compliance with all existing guidelines. That also means keeping up-to-date with changes or updates to safety standards and ensuring that equipment, tools, and materials are used according to these regulations. Safety audits and inspections; Regular inspections can identify areas that need to be improved to achieve a better and safer working environment (Ebeigbe & Ikeneri, 2011).

One important thing to do to make sure educational ceramic studios and workshops are safe is to follow national safety codes. But it does not name or provide details of these codes. National safety codes generally have rules and guidelines that are put in place to help protect people from possible dangers that could arise from equipment, materials, and practices. These can differ from country to country, but can include topics like fire safety, handling chemicals, operation of mechanical equipment, and general workplace safety. There will, however, be specific national safety codes pertinent to ceramic studios and workshops, which would have to be sought by looking up the regulatory bodies responsible for occupational health and safety. They are typically the bodies that offer access to the applicable codes and guidelines for educational and workshop settings.

Institutional policy on safety rules often revolves around a framework that ensures the health as well as safety of all organization members. These frameworks may consist of, however, not limited to: Compliance with Legal Requirements, Risk Assessment and Management, Training and Education, Emergency Preparedness, Reporting and Investigation, Continuous Improvement, Employee Involvement, etc. Health and safety policy can be customized by each institution according to the needs of the institution, requirements of the industry, specifications determined for the industry, as well as the hazards of its operations. Still, the underlying goal is the same: to provide a safe and healthy environment for all.

Conclusion

There is no arguing about the absolute need for a safe space in ceramic studios and workshops, particularly in educational environments. Educators and students can take advantage of this guide and implement the guidelines and practices so that they can achieve a safe and productive workspace. Such preliminary measures are necessary to keep people safe from the threats posed by kiln use and ceramic materials and to cultivate an attitude of responsibility and respectfulness toward the art. While ceramic processes continue to be a common narrative in educational institutions, it is pertinent that the principles outlined in this guide are essential in preserving the well-being of all participants (staff and students) and ultimately creating sustainable practices and a creative environment free of hazards for the ceramic arts. That's also understandable, there must be things that go against hazards in the studio. Thus, there is always a potential period to encounter workplace hazards. Not predicting the possible hazards in the work environment would be a naïve decision by both staff, students, and other studio practitioners.

This approach requires following some appropriate guidelines and recommendations to guarantee safe working practices in studio and workshop environments, particularly those associated with ceramics. This involves proper training and familiarization with all ceramic equipment, tools, and materials, and how to handle them safely, as well as keeping a safe and clean workspace for ceramic practice. Proper maintenance and equipment inspection can avoid these types of malfunctions, which can result in injury. Routine workplace cleaning to mitigate any dust accumulation, as well as an understanding of the specific hazards associated with the quantities and materials you're working with, is also a good way to ensure your worksite remains the safest it can be. Proper ventilation systems must be put in place to ensure that toxic dust and fumes are not inhaled. Finally, protective equipment (safety goggles, overall, gloves, etc.) should be provided and users trained on how to use them, along with clear and accessible emergency procedures (e.g., fire extinguishing, evacuation exit, etc.) for the safe utilization of the workspace and its equipment.

Additionally, AI can revolutionize studios and workshop environments by facilitating the customization of learning experiences, along with the automation of administrative labor. Artificial Intelligence has great potential in creating personalized experiences in creative environments, where AI-powered instruments end up examining published books to individual students by teaching them how to cultivate responses and open opportunities for near-infinite customization of feedback. For instance, after analyzing a student's work, machine learning algorithms can suggest resources tailored to that individual's needs and allow instructors to give more personalized feedback. This flexibility may lead to better outcomes for students and would allow educators to focus more on innovation and creativity, rather than drowning in administrative duties. Moreover, AI technologies help improve operational efficiency in workshops by strategizing non-core processes like inventory management and materials handling. Through the use of advanced data analytics, educators can track tool and material consumption that reduces waste, while ensuring that valuable resources are available on demand. For teachers, predictive analytics predicts materials usage trends so that teachers can manage their needs and resources. These new efficiencies free up time for students to engage in hands-on learning, experimentation, and creativity, instead of logistical headaches that drag exhausted teachers down.

References

Abamwa, O. E. (2002). Production and firing techniques of Ughevwughe and Otor- Edo potters. Pam Unique Publishers.

Agumba, M. and Abbott, A. (1996). *How to build, use and maintain a born fire kiln*. http://med.iiab.me/modules/en-practical_action/Energy/Stoves%20and%20Ovens/better_bonfire_kiln.pdf

Atuh, G. N. and Ozidede, M. (2023). *Design, operation and management: a step-by-step kiln building repor*t. A conference paper presented at the 18th Annual Ceramics Researchers Association of Nigeria Conference (CerAN), held from 10th - 13th October 2023 at Ahmadu Bello University, Zaira.

Bazunu H.U.M and Odokuma E. (2008). The design of a throwing wheel through using thixotropic polyester. *Ashakwu Journal of Ceramics,* 4(2), 17-22.

Burton, J., Horowitz, R., and Abeles, H. (2000). Learning in and through the arts: The question of transfer. *Studies in Art Education*, 41(3), 228-257.

Ceramic Art Network. (2024). *Essential guidelines for a safe and healthy pottery studio*. https://ceramicartsnetwork.org/daily/article/Essential-Guidelines-for-a-Safe-and-Healthy-Pottery-Studio.

Curious Mind. (2023). *Ceramics – introduction*. http//:www.sciencelearn.org.nz.

Ebeigbe, S. U, and Ikeneri, J. (2011). Safety pottery in Nigeria: Advocacy for public awareness, control and prevention. *Ashakwu Journal of Ceramics*, Volume 8: 29-35.

Ebeigbe, S. U. (2011). The production of stoneware glaze using local raw materials: cement, feldspar and quartz. *Ashakwu Journal of Ceramics*, 8, 36-43.

Eisner, E. W. (2002). *The arts and the creation of mind*. Yale University Press.

Hawley, N. J. (2018). Waste as a resource: An exploration of sustainable processes in the ceramics studios of UKZN through the practice and creative production of Natasha Jane Hawley. Master's Dissertation submitted at the University of KwaZulu-Natal.

Heim, A., Olejnik, T. P., and Pawlak, A. (2005). Rate of ceramic body grinding in a ball mill. *Physicochemical Problems of Mineral Processing*, 39, 189 - 198.

Igbinedion, S. J (1995). *Introduction to industrial ceramics*. Uri Publishing Limited.

Johnston V, and Lipscomb J. (2006). Long working hours, occupational health and the changing nature of work organization. *Am J Ind Med*, 49, 20-4.

Kickpatrick, T. (1978). Barium metals and barium compounds. In Grayson M. and Eckroth D (Ed.), *Encyclopedia of Chemical Technology*. John Wiley and sons, New York..

Kurtul, S., Ak, F. K. and Türk, M. (2021). Frequency of pneumoconiosis and related factors in ceramic workers admitted between 2016 - 2018 to the Occupational Diseases Clinic of the University Hospital in Turkey. *Iranian Journal of Health, Safety & Environment*, 7 (2), 1437-1443

Livingstone A., and Petrie K. (2017). *The ceramics reader*. Bloomsbury Academics.

Longhurst, D. (2010). Economics and methodology of ball mill media maintenance. In *Cement Industry Technical Conference,* 2010 IEEE-IAS/PCA 52nd.

Maniatis, Y. (2009). The emergence of ceramic technology and its evolution as revealed with the use of scientific techniques. In Shortland, A. J., Freestone, I. C. and Rehren, T (Ed.), From mine to microscope: Advances in the study of ancient technology (pp. 1-8) . Oxbrow Books.

Matizamhuka W. R. (2019). Advanced ceramics - the new frontier in modern-day technology. *Journal of Southern African Institute of Mining and Metallurgy,* 118, 758 – 764. http://dx.doi.org/10.17159/2411-9717/2018/v118n7a9. ISSN 2225-6253.

Melzer, A. C. (2010). Working conditions and musculoskeletal pain among Brazilian pottery workers. *Cad Saúde Pública*, 26, 492-509.

Mishra, M. K., Moharana, S., Satpathy, S. K., Mallick, P., and Mahaling, R. N. (2023). Perovskite-type dielectric ceramic-based polymer composites for energy storage applications. *Perovskite Metal Oxides*, 285-312. https://doi.org/10.1016/B978-0-323-99529-0.00014-X

Nelson, G. C. **(**1983). Ceramics: A potter's handbook. 5. Cengage Learning.

Nwigwe, C., Asogwa, O., and Okafor, M. (2024). Dress as the agency of power: Ozioma Onuzulike's ceramic art. fashion theory, 28(5-6), *789-812* https://doi.org/10.1080/1362704X.2024.2388945

Ojie G. N. and Egede S. C. (2009). Throwing wheel revisited: constructing a prototype bench wheel using local materials. *Journal of the Craft Potters Association of Nigeria* (CPAN), 2&3, 17 – 22.

Ojie G. N. and Egede, S. C. (2002). Plantain and palm frond ash: a matrix for soda glaze composite. *International Journal of Laboratory Technology (JOSCILT)*, 1(2), 1-6.

Ojie, G. N and Egede, S. C. (2010). Pottery traditions in the Niger Delta region of Nigeria: Discussions of processes. *International Journal of Ceramics Technology,* 30.

Ojie-Ogwu G. N. and Ozidede M. (2021). Clamp kiln building and construction: Cost-effective brick firing method for potters. *Environ: Journal of Environmental Studies*, 4 (12), 25 – 31.

Ojie-Ogwu, G. N. (2013). Review of the security/hazardous challenges associated with the use of kilns for ceramic production. *Gender Creativity Journal of Female Artists Association of Nigeria,* 2(1).

Ojie-Ogwu, G. N. (2016). The role of art education in contemporary Nigeria: Review of effective engagement of art skills by trained artists. Ukala Sam C (Ed.) *Abraka Studies in African Arts. African Arts and National Developmen*t (351-357). Kraft Books Limited.

Osinubi M.O, Rotimi B. F, and Popoola G.O. (2017). Hazards awareness and practice of safety measures among pottery workers in Ilorin, Kwara. *Int J Med Biomed Res*, 6(3), 101-124. http://dx.doi.org/10.14194/ijmbr.6.3.1

Otimeyin, P. (2015). *Ceramics at a glance* . Ambik Press Limited.

Ozidede, M. (2017). *Construction of a multiple-fueled powered kiln for ceramic production*. An unpublished dissertation submitted to the Department of Fine and Applied Arts, Delta State University, Abraka, Nigeria.

Ozidede, M. (2024). The role of ceramics in the traditional rites of passage in African religion. *Abraka Journal of Religion and Philosophy (AJRP),* 4(2), 100 – 114. https://dymsb.com/index.php/ajrpdeltastateuniversityabraka/article/view/413

Ozidede, M., & Ofili, E. J. (2024). Design and fabrication of a ball mill from discarded solid materials for sustainable ceramic production. ISSN 2971-5083. *Environs Echoes*, 3(2), 40-53.

Peterson, S. (1996). *The craft and art of clay*. The Overlook Press.

Porter L. C. (2016). *The impact of studio space on creativity and its implications for artistic practice.* https://etheses.whiterose.ac.uk/id/eprint/16465/

Raby, J. (2015). *Materiality, memory, metaphor – convergence of significance in the ceramic vessels*. Doctor of Philosophy thesis, University of Brighton, UK.

Sakar, A. Kaya, E, and Cdik, P. (2005). Evaluation of silicosis in ceramic workers In Hong Kong. *Toberk Toraks*, 53, 148-55.

Scottish Potters Association (SPA). (2021). Health and safety policy. https://www.scottishpotters.org/assets/AGM-2021/6.-SPA-Health-Safety-Policy.pdf

Sherma P., Sharma S., and Khanduja. (2015). On the use of ball milling for the production of ceramic powders. *Materials and Manufacturing Processes*, 30, 11, 1370 – 1376. http://dx.doi.org/10.1080/10426914.2015.1037904.

Sicotte, H., De Serres, A., Delerue, H. and Ménard, V. (2019), Open creative workspaces impacts for new product development team creativity and effectiveness. *Journal of Corporate Real Estate*, 21, 4, 290-306. https://doi.org/10.1108/JCRE-10-2017-0039

Song, H., and Cai, L. (2024). Interactive learning environment as a source of critical thinking skills for college students. *BMC Med Educ,* 24, 270. https://doi.org/10.1186/s12909-024-05247-y

Speight C. F. and Toki J. (2003). *Hands in Clay*. McGraw-Hill.

Suckley, L., and Nicholson, J. (2018). Enhancing creativity through workspace design. In: Martin, L., Wilson, N. (Ed.). The Palgrave Handbook of Creativity at Work (pp.45-263). https://doi.org/10.1007/978-3-319-77350-6_12

Sutas, P. (2022). *Relations of techniques and the mental states in ceramics making: Participants' mood change caused by ceramic art workshops*. An unpublished dissertation submitted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy at the Graduate School of Engineering, Fukui University of Technology, Japan. https://fut.repo.nii.ac.jp/record/2222/files/Sutas20220316.pdf

Taylor, L. (2011). Ceramics: Tools and techniques for the contemporary maker. Words & Visuals Press.

The Encyclopedia Britannica (1998).*The Encyclopedia Britannica*, 15th Edition, 10, 218 – 219.

Yu, H. (2024). Enhancing creative cognition through project-based learning: An in-depth scholarly exploration. *Heliyon*, 10(6), e27706. https://doi.org/10.1016/j.heliyon.2024.e27706