

Research Article

CONSTRUCTION OF CHASIS FOR BRICK-BUILT MOBILE KILN: A MODEL FOR TEACHING AND LEARNING CERAMIC EDUCATION

* Ejiogu Fidelis Onyekwuo

Department of Fine and Applied Arts, FCT College of Education, Zuba-Abuja Nigeria.

Received 17th February 2021; Accepted 19th March 2021; Published online 28th April 2021

ABSTRACT

Brick-built kiln is a long aged firing gadget among the people of different culture where the use of clay is predominant. Before brick-built kiln, firing is done openly and as civilization evolved the development of building kiln becomes possible. However, kiln building is a static structure from time immemorial evolving new technology ranging from brick to electric kiln, gas kiln, kerosene kiln, salt kiln and solar kiln (which are not really viable as too much structure is required to bring a tiny piece to a required temperature). The strength of brick-built kiln cannot be overemphasized as the dynamic of clay makes it cheaper and durable to handle in higher institution where most students are living below poverty line. This study examined mobile kiln with chassis, constructed from metal and iron for possible multipurpose functions such that it can serve as instructional aid in teaching and learning ceramic education even at basic education level. The method is experimental where practical application of tools and materials were manipulated to produce constructive movable chassis in order to move around brick-built kiln for various uses. The study aims at improving teaching pedagogy by enhancing proficiency in ceramic education with recommendations to justify the inclusion of this study.

Keywords: Construction, Chassis, Brick-Built Mobile Kiln, Model of Teaching and Learning, Ceramic Education.

INTRODUCTION

Ceramic education is basically applied art which aims at specific functional or utilitarian purpose. However, the process that culminates to ceramic ware starts from clay and possibly ends with firing. For instance, several ceramic wares have been fired through open firing in the Department of Fine and Applied Arts, FCT College of Education, Zuba-Abuja Nigeria before the provision of kiln which has now made firing more efficient and labour-reduction. The students have been exposed to local firing of all sorts as well as wood, gas and kerosene-aided firing with brick-built kiln. This has strengthened their capacity and proficiency in the area of ceramics to the extent that they can be self-sustained which is the core objective of this study. Clay is the primary material in building kiln for wares to be fired therein. Hence, clay is classified into many structures based on their mineral resources. The study would make use of refractory clays to construct the kiln. Refractory clays are used to make kiln furniture including stagers. It can be fired repeatedly and have a maturing temperature of cone 14 or 2500 degrees Fahrenheit (Constro, 2020). The onus specifically in this study is to construct metal and iron chassis for kiln in order to move it around for use. Chassis is locomotive suspender, rigid metallic frame or skeleton to which all the mechanical parts are attached. The chassis is the backbone of the vehicle, thus it gives strength and stability to the vehicle (Emmy, 2017). In this case, a skeleton-like structure as the base was constructed on which brick-built kiln would restfully attach for locomotive purpose. The construction adopted welding approach to fix all configurations together. Meanwhile, various teaching methodology have been introduced to enhance teaching-learning activities in Fine and Applied Arts Department for a long time. It is only reasonable as a matter of development and versatility to introduce a new methodology. It is to this end, that this study seeks to expose students to a more interesting and self-sustaining entrepreneurial skill training which the study provides.

Statement of the Problem

In ceramic production, temporary clay material is brought to permanence through heat temperature (Fraser, 1998) as aided by the kiln. The product of this firing is functional and aesthetic for various purposes; hence kiln which is the hub of ceramic production that should be available and accessible without hindrances. The use of ceramic kiln should be a course of study that must be exposed to primary and secondary schools as well as individual upcoming entrepreneurs whose primary aim is to be trained and improve practical skills in creative production of pottery. At the moment, the quest for domestic utilization of local content is increasingly becoming obvious in the Nigeria economic terrain for gross domestic product (GDP) increment. Besides, Federal Capital Territory Administration has tasked all her agencies which FCT College of Education Zuba Abuja is a stakeholder to be proactive toward genuine innovation that can contribute immensely to the growth of Federal Government economy. This task can only be achieved through numerous ways which this study is significantly leveraging upon. In the FCT College of Education, Department of Fine and Applied Arts where suspended static brick-built kiln (figure1.) has been in use for a long period of time, it is not only observed that the kiln is limited in service (especially when community service geared toward production of ceramic wares at a remote distance from the College) but also that the students have never been exposed to the construction training which apparently is absent in their curriculum contents breakdown. However, this position can be changed by possible provision of locomotive kiln for an improvement in proficiency, bringing learning to 'door to door' and help facilitating smooth running of teaching/learning process, bearing in mind that ceramic education is incomplete without firing and glazing.

*Corresponding Author: Ejiogu Fidelis Onyekwuo,

Department of Fine and Applied Arts, FCT College of Education, Zuba-Abuja Nigeria.



Figure. 1. Suspended brick-built static kiln in the FCT College of Education Zuba-Abuja. Department of Fine and Applied Arts (Ejiogu, 2021)

Objectives

- To construct quality and innovative mobile kiln chassis using locally sourced materials.
- To project this innovative idea for consumption of the individual entrepreneur, government and educational institutions.
- To facilitate effective teaching of ceramics and clay related activity.
- To expose students to training of construction of mobile kiln chassis.
- To promote local content and appreciation of creative idea.

Research Questions

- How is quality and innovative mobile kiln chassis using locally sourced materials constructed?
- How is this innovative idea for consumption of the individual entrepreneur, government and educational institutions projected?
- How can effective teaching of ceramics and clay related activity be facilitated?
- How would students be exposed to training of construction of mobile kiln chassis?
- How will local content and appreciation of creative idea be promoted?

Justification of the Study

The development of education in Nigeria over the years has made several attempts to project practical and technical skills acquisition possible by introducing several educational policies in the school system. Ceramic education is a branch of visual arts involving practical teaching and learning methodology. Hence this research will be justified in the following ways:

- It is yet another curriculum methodology to teaching ceramic education via welding which will assist Nigeria Certificate in Education (NCE) students in practical impartation of new skills for self-reliance.

- This study will help to fulfill personal dreams of the individual students who wish to specialize in ceramics as a career.
- It will help in turning out individual teacher educator cum entrepreneurs with sustainable skills that will eventually contribute to economic development and cushion the effects of hardship.
- Also, the use of mobile kiln will find its usefulness among ceramic trainers and freelance artists whose business is to educate interested candidates in the art of pottery. It can easily be moved around to facilitate training in the respective training centres irrespective of the distance.
- The construction of chassis and making of mobile kiln can be a source of internally generated revenue for education managers like Federal Capital Territory (FCT) Education Secretariat, Universal Basic Education Board (UBEB) and Secondary Education Board (SEB) to acquire some for lease at subsidized rate.

Environmental Implication

The production of chassis for the mobile kiln will not have negative impact on the environment as the smoke from welding escape quickly to the air.

LITERATURE REVIEW

Ceramics is the use of moist plastic clay and/or other earthen mineral substances to shape an object which is left to dry, biscuit/gloss fire to become hard, dense, glossy and permanent (Alasa, 2005). However, for ceramics to achieve permanence through firing Peterson (2017) noted that the amount of temperature needed to transform soft into hard ceramic is extremely high and is provided by the kiln. Ceramics is viewed by Alasa (2005) as a product manufactured by heat treatment of material (or mixture of materials) which is inorganic and non-metallic. This is to corroborate the earlier submission and also emphasize the importance of firing of clay before it becomes a ceramic ware. Firing is the climax of a potter's labour (Fraser, 1998). The most carefully produced pieces may easily be ruined if the firing operation is not carried out correctly. Although, firing can take place in the open but how much can the temperature be controlled to achieve object permanence? Hence, for a ceramic ware to obtain this form, it must be fired at the temperature range from approximately 600° C (1112 F) to 1360° C (2480° F) (Zakin, 1990). This can only be achieved by the kiln firing method. It then means that when children are taught pottery in creative arts in the basic and secondary school education in Nigeria and firing of clay ware is not done (as it is being witnessed in most of these schools), hence, the knowledge is incomplete. In this study particularly, the making of brick-built kiln is taking a new dimension by the construction of chassis with movable locomotive to support movement of the kiln. Mishra (2014) opined that as human or animal has skeleton to give it a desired shape and size, in the same way the cars have skeleton-like structure called chassis to give it strength and shape. Hence chassis is the main support structure of the vehicle which is also known as 'Frame'. It bears all the stresses on the vehicle in both static and dynamic conditions. In a vehicle, it is analogous to the skeleton in living organisms (CarBike Tech, 2019). Irfan mechanical strength against forces from anywhere. These tubes are welded together and form a very complex structure (Student lesson, 2019). However, this study adopts the former which is the ladder frame in constructing the chassis.

RESEARCH METHODOLOGY

(2020) noted that chassis are of two types namely; Ladder Frame Chassis and Tubular Frame Chassis. Ladder frame chassis is a body-on-frame chassis and is a robust metal framework consisting of two large metal beams joined together by shorter support beams in between (Undercoffler, 2020). While Tubular Frame Chassis employs dozens of circular-section tubes (some may use square cross-section tubes for easier connection to the body panels, though circular section provides the maximum strength), positions in different direction to provide The research was experimental and adopts descriptive analysis to bring about detailed explanation of construction of chassis.

Sampling and Sampling Procedure

Pilot Study/Production: There are many areas where welding and panel beating work is done around Abuja metropolis but the research took Auto Spare Parts Market Zuba Pan-taker, Gwagwalada Area Council of FCT Abuja for its pilot study (because it is the localization of auto-welding works in the area) while FCT College of Education Zuba-Abuja, served as the production site.

Method of Data Collection

The study employed interview technique to obtain information on the mode of chassis construction among the auto-mechanics and panel beaters that work and fabricate mainly on vehicle chassis from scraps. Also, the study used participant observation, focus group discussion, and secondary sources (book, journal, monograph and internet provision).

Method of Data Analysis

Tools and Materials for Production: Angle and flat iron metal, electrode, welding machine, gas, sketch pad, rotering pen, grinding machine, filing machine, pencil, hammer, welding machine, tubeless tyres, measuring tape, boris, bolts and nuts.

Analysis/Result Presentation

Sketch of the Chassis

The research did not adopt conventional shape of chassis instead the sketch took peculiarity of the kiln shape usually rectangular in drafting the sketch (figure 2).

Sourcing of Materials

The study sourced all its materials at Pan-taker area of ZubaGwagwalada Area Council of FCT Abuja, where iron and metal wastes are dumped for recycling.

Measurement and Cutting of Iron

Some pieces of 3mm angle-iron were measured in 2feet, 10 inches length and cut with cutting machine into four equal parts forming cuboid shape. The base for chimney was also cut into four rectangular equal parts with each side measuring 1 foot. Subsequently, four pieces of 3feet angle-iron were also cut as elevation pole that will hold the chassis and body frame of the kiln, Thereafter, 3feet angle iron standing for chimney wall was also cut into four equal parts. Two 3feet length of flat bar representing both front and rear axle were cut, while 10 flat bars representing cross members to fill and braze the base of chassis were cut in 2feet, 10inches (figure 2. a, b).



Figure 2a. Measuring angle bar for chassis frame (Ejiogu, 2021)
Figure 2b. Cutting of flat bar for chassis frame (Ejiogu, 2021)

Welding

The welding is done using electrodes and converter as bond to heat all iron parts together in forming skeleton frame. The four pieces of base angle-iron were the first to be welded together as the frame base while others were falling in place as the welding progressed. The two metal axles were welded at the bottom part of the frame (front and back) to hold the tyres to the frame (figure 3, a, b).



Figure 3a. Welding of iron parts together (Ejiogu, 2021)



Figure 3b. Fixing of tyre with the axle via the hub (Ejiogu, 2021)

Finishing

The chassis frame was smoothed with filing machine and sandpaper to make for better outlook (figure. 4a, b).



Figure 4a. Complete mobile chassis for brick-built kiln (Ejiogu, 2021)



Figure 4b. Researcher and students in making of chassis for brick-built kiln (Ejiogu, 2021)

DISCUSSIONS

The study exemplified practical application of tools and materials through creative craftsmanship to fabricate mobile chassis frame which strength can accommodate brick-built kiln, having sourced the materials locally at the Pan-taker ZubaGwagwalada Area Council of FCT. The use of machine in some instances is to facilitate easiness of the work as Alexis's (2017) suggested and re-invigorated by Adebisi (2014) that the use of technological device is to achieve efficiency and precision of craftsmanship as proposed by objective 1. In line with objective 2, this study is a government facilitated research which aims at improving local productivity. In its entirety, it is a novel idea which has not been done anywhere around the world portends viable economic benefits from patronage by entrepreneur, government and educational institutions. A novel idea of this nature surely encourages the government to do more as proclaimed by the Minister of Education (Adamu, 2019). His submission is consistence with the mission of Federal Ministry of Education: "Our mission is to

use education as a tool for fostering the development of all Nigerian citizens to their full potentials, in the promotion of a strong, democratic, egalitarian, prosperous, indivisible and indissoluble sovereign nation under God" (FME, 2019). The study has changed the face of ceramic education in the FCT College of Education Zuba-Abuja as many students are now aware of entrepreneurship inclination in ceramics from their participation. Students are eager to see the completion of the novel project, while the steps to production have been so interesting to the extent of attracting observation of students from other departments. This is in support of objective 3 and 4 of this study. Adeoti (2020) described students participation in the process of making ceramics has a fit in the teaching approach of new skill and knowledge. It must be mentioned that the use of clay in the advancement of this study is a consumption of local content. Besides, metal and iron used in this research were locally produced by indigenous company which could be said to have fulfilled objective 5.

Recommendations

- Government must as a matter of urgency increase financial assistance and budgetary allocation to education sector in order to facilitate more research that is economic-driven.
- There should be curriculum review in line with the economic quest in the Colleges of Education to be more practical oriented, bearing in mind that not all the graduates are likely to teach after graduation. Some of the students may want to take up entrepreneurship for self-reliance in line with Sustainable Development Goals. It is expected that before their graduation, students should have been equipped in double strand of skills both in teaching and self-employment which their training would have provided.

Conclusion

The use of metal and iron in this study is simply within the ambit of visual arts, apart from this fact; it is a means to the end production its own. Mention must be made that construction of mobile kiln chassis is a part of fully funded research which is preliminary to achievement of full mobile brick-built kiln which is the main reason for this study. Ceramic education is multifaceted in approach and this study is yet another concept of teaching to achieve not only qualitative product but also innovative idea that can add to cushion effects of poverty in the land if it is well managed.

Acknowledgment

The author gratefully acknowledges the financial support of the Tertiary Education Trust Fund (Tetfund) toward accomplishment of this research.

REFERENCES

- Adamu, A. (2019) Re-Engineering Educational Standard to Cater for Dynamic Societal Changes in 21st Century. An Opening Speech for Nigeria's Annual Education Conference 2019.
- Adebisi (2014) Man and machine in the twentieth century civilization. *Journal of Global Technological Development*, 2(4).
- Adeoti, A. (2020) Ceramic Clay-Arc-Decor: A New Technology for Interior and Exterior Column Designs. *International Journal of Research Publications (IJRP)*.60 (1). Available online at <http://ijrp.org/paper-detail/1408>
- Alasa, S. (2005). *Fundamentals of Ceramics*. Benin. Mara Mon Bros, Enterprise.

- Allexiss, P. (2017) Art and Technology: The World Now. Minessota, Hagg Publishers.
- CarBike Tech. (2019) What Is A Chassis And What Are Its Types? Retrieved March 2, 2021 from <https://carbiketech.com/chassis/>
- Constro, F. (2020) Use of different types of clay in construction. Retrieved August 22, 2020 from <https://www.constrofacilitator.com/use-of-different-types-of-clay-in-construction>
- Emmy, C.N. (2017) Thee two main types of vehicle chassis and qualities. Retrieved March 2, 2021 from <https://www.goggle.com/amp/s/mobilityarena.com/two-main-types-of-vehicle-chassis-qualities/>
- Federal Ministry of Education.(2019) 'Mission Statement'. Retrieved April 4, 2021 from www.education.gov.ng.
- Fraser, H. (1998) Glazes for the Craft Potter. London. A&C Black (Publisher) Ltd.
- Irfan, S. (2020) What are the Types of Automobile Chassis ? Retrieved March 2, 2021 from <https://autoexplor.blogspot.com/2020/04/what-are-types-of-automobile-chassis.html>
- Mishra, P. (2014) Types of Chassis and Different Types of Cars According to Body Style. <https://www.mechanicalbooster.com/2014/02/what-is-chassis-in-automobile-how-many-types-of-car-according-to-the-body-style.html>
- Peterson, B (2017). An Overview of the Firing Process. Retrieved July 12, 2017 from <https://www.thespruce.com/an-overview-of-the-firing-process-2746250>.
- Student lesson. (2019) Types of Chassis. <https://studentlesson.com/conventional-and-non-conventionaltypes-of-automobile-chassis-studentlesson/>
- Undercoffler, D. (2020) A Body on frame vs. unibody: Pros and cons. Retrieved March 3, 2021 from <https://www.autonews.com/article/20170626/OEM01/170629864/body-on-frame-vs-unibody-pros-and-cons>
- Zakin, R. (1990) Ceramics: Mastering the Craft. London. A&C Black (Publisher) Ltd.
