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Appropriate Methods of Storage and Security for Industrial Technical Education Workshop Facilities for Effective Instructional Activities

By

ISYAKU MOHAMMED DABBAN
Department of Education (Technical),
Kaduna Polytechnic,
Kaduna.

Abstract

Proper storage of tools, equipment and other facilities in the workshop prolongs their life span. It also guarantees ease of dispensing and promotes a high degree of efficiency in their utilization for skills acquisition. The cornerstone for rapid technological, economic and industrial sector development is the acquisition of functional skills through the application of tools, equipment and consumable materials. This paper basically elucidates appropriate methods of storage for tools, equipment and material in industrial technical education workshops. The paper further dwells on security of tools, equipment and materials to prevent them from theft or careless losses. Some fundamental poor storage practices were identified and recommendations were proffered on the way forward.

Storage of workshop facilities such as tools, equipment and consumable materials via appropriate methods permits easy accessibility to their respective location. In its broad perspective, workshop facilities refer to the workshop infrastructure and its units such as office accommodation, toilets, urinary and accessibility to the workshop building as well as tools and equipment. Olaitan, Igbo, Ekong, Nwachukwu and Onyemachi (1999) distinguished between fixed and other facilities and revealed that fixed facilities are positioned at a place for the performance of specified and specialized operations or for providing required services. Olaitan et al cited examples of fixed facilities as workshop meant for woodwork, metalwork, automobile, electrical/electronics operations, etc with fixed equipment or machines. Fixed "facilities are immovable and may be manually, mechanically or naturally fixed. Tools are the

devices or instruments that can be handled easily while carrying out special operations as well as instructional and learning activities. This brings to focus the importance of consumable materials as a pre-requisite for effective instructional activities in industrial technical education workshops.

This paper focuses on methods of storage for tools/ equipment, materials, students' projects and storage devices for raw materials as well as the security of the aforesaid facilities. Against this background an attempt was made to identify some of the poor current storage practices for workshop facilities. It is therefore imperative to note that skills acquisition which is a requirement for rapid technological and industrial growth can only be achieved if these facilities are properly stored and secured for effective instructional activities.

Methods of Storage for Workshop Facilities

Toots supplies and students' projects can be stored using several methods. On tools Storage, Hill and Brown, (1975) stated that most tools used in industrial arts Laboratory must be readily available to students, and are usually stored in one of three ways:

(i) **A Comprehensive Tool Panel** - These are of two types: open or locking. This type of tools storage places most of the tools near the point of use, for example, the bench area and it is easy to check at the end of each class period. But if a locking cabinet is employed to house the panel, security is as good as that of a tool room. Obviously, the major weaknesses of a comprehensive tool panel is that tool storage is not localized to the extent desirable in most laboratories.

(ii) **Tool Panel Series** - This consists of open panels or locking cabinets, which localizes tools in areas of greatest need, and it is probably the best alternative. Most importantly, each panel must be complete enough to serve the area in which it is installed. This way, students travel is minimized and the selection of the correct tool for each job is facilitated. Although a tool panel series may increase the time it takes to check tools at the end of each class period, the task is not difficult.

(iii) **The Tool Room** - This contains all necessary tool panels, drawers, shelves, and cabinets. It is an alternative that offers excellent security, but it tends to be time-consuming to administer properly. Basically, a student tool room foreman is often required to operate a tool room. This system of tools storage is practiced in most industrial technical education workshops in Nigeria and the services of a store officer is employed to take charge of the tool room rather than that of a student foreman.

Grimaldi and Sirnonds (1975) also believed that a centralized tool supply and maintenance is often preferred. In the same vein, Ogwo (2003) stated that tool cases have an advantage over open tool panel because it may be locked. Other methods of tool storage according to Hill and Brown (1975), include carts of tools that can be moved from place to place and tool kits. Storage of portable power tools can be done effectively in pigeonhole storage devices installed in locking tool cabinets. But in some cases, substantially moisture-free storage must be provided for equipment that can be damaged by excessive humidity. Usually this requires a room in which the humidity is carefully controlled. On the whole, whatever the system of tool storage that is chosen, it should possess the qualities of ease of dispensing and replacing tools, convenience of checking, and security. However, Okorie (2001) noted that improper storage of tools and materials, tools not put properly in their racks, boxes, cabinets; congestion of tools and materials in the work area is unsafe and can lead to accidents. It therefore becomes necessary for the workshop staff to observe proper techniques of storing tools and supplies in the laboratory.

Consumable Materials and Storage Systems

Hill and Brown (1975) stated that materials may be stored within each laboratory or kept in a central supply room and dispensed to the entire complex of laboratories from that point. It is noteworthy that central storage requires the services of a full-time stock manager and a number of clerks. The latter system is time consuming because students must leave the laboratory to the supply room and return, each time stock is needed. Although central storage has a substantial advantage of relieving the industrial arts teacher of the tasks of storing, dispensing and accounting for materials, stock security is also excellent in a central storage supply room. However, laboratory storage despite its several disadvantages is the system that is universally used.

Laboratory storage offers a degree of flexibility that is important to smooth laboratory operation, because it places materials as near as possible to the point of use.
With respect to storage facilities, every industrial arts laboratory should be equipped with storage rooms, where the bulk of the materials are kept, and storage areas in which small quantities of materials for day to day use are kept. It is important that in some cases, rupture-proof and fire-proof containers must be provided for flammable materials, such as solvents, finishes, fuels and lubricants. However, small quantities of non-flammable materials can be stored in student Lockers. In the design of most Laboratories it is necessary to incorporate a major and minor storage room, Each type of the rooms mentioned should have features like: (a) a convenient location; (b) adequate floor space: (c) storage devices that classify 'materials and keep them in good condition; (d) an efficient dispensing system, and (e) adequate provision for security (Hill and Brown, 1975).

A major storage room is employed to store bulk quantities of raw materials used in construction of projects such as lumber, plywood, metal, sheet metal, plastic and

leather (Hill and Brown, 1975; Ezeji, 2004). In support of this view, Ogwo (2003) stated that a storage room of 10 by 15 feet (about 3.05 meters by 4.57 meters) will usually meet this need because metal and lumber is often, shipped in twelve feet lengths (about 3.66 meters). However, a minor storage room is designed to handle supporting materials such as adhesives, abrasives, finishes, hardware, and other materials. It is worthy of note that a minor storage room, if large enough can also be used to store spare parts and special equipment (Hill and Brown, 1975). In his contribution, Ogwo (2003) stated that in line with good house-keeping, it is essential to provide a place for proper storage to eliminate storage in corners, on the floors of the workshop or under the benches. It is pertinent to note that methods of storage adopted by technical staff may differ from the techniques mentioned above. Storage devices necessary for effective storage of materials include among others, horizontal and vertical racks, shelves, cabinets, bins and drawers (Hill and Brown, 1975; Ogwo, 2003).

Vertical storage is best for lumber as it utilizes air space that would otherwise be wasted. It keeps lumber in the best possible condition, makes dispensing and replacing easy and is much safer than flat storage. Metal rods, bands, angles and similar forms of materials should be stored horizontally if their length exceeds eight feet (about 2.4 meters). Sheet materials, especially those with uniform size and appearance such as plywood, hardboard, particle board, and sheet metal should be stored flat. This is very essential where warping will ruin the stock for many purposes and plywood especially may loose its straightness if stored vertically. It is imperative to note that each thickness, type, and gauge of sheet material must have its own section in the rack to facilitate dispensing. Lockable steel storage units are ideal for storage of costly and/or valuable materials and two or three of such storage units should be provided in the instructors' office (Hill and Brown, 1975). Perhaps, storage techniques adopted by technical staff in industrial technical education workshops differ from the techniques mentioned above especially for some materials. Experience has shown that planks are stored horizontally instead of keeping them vertically, finishes are sometimes kept in the general tool room instead of a separate storage room and tools are sometimes mixed up on shelves in the store room.

Storage of Students' Projects

In the design of industrial technical education workshops, it is necessary to provide storage areas for both completed and uncompleted students' projects. To buttress this assertion, Ezeji (2004) pointed out that separate storage for students' projects that provides easy access yet safe storage must be included in the design. Ezeji stated that projects require much space especially where separation of projects by classes is desired. However, adequate storage areas are often overlooked in the basic planning of laboratories with the result that the instructor must sacrifice valuable laboratory space with resultant safety hazards

For uncompleted projects, Hill and Brown (1975) emphasized the need to plan a significant amount of "live" materials storage into every industrial arts laboratory. Hill and Brown defined live storage as storage that is provided for materials being processed and for projects in all stages of completion. The co-authors advocate a project storage room that is capable of storing 120 or more projects of various kinds - approximately 400 square feet of floor space, in the case of woodwork laboratory (about 37.2 square meters). In addition, a project assembly area of at least 200 square feet (about 18.6 square meters) will provide sufficient live storage for laboratories in which large projects are undertaken.

Storage facilities, according to Ogwo (2003), should be applied not only to supplies, tools and equipment, but also to project parts which the students must store from day to day. Therefore, provision of lockers for project parts, materials, apron, etc., is deemed imperative for each student. A locker with separate students' compartments and one that may be locked after workshop period is most desirable. Each student should therefore be given a locker space and then be expected to manage it properly. Several lockers should as well be reserved for the teacher.

However, some of the storage techniques mentioned above are not strictly adhered to in industrial technical education workshops as uncompleted projects are sometimes stored around machines and equipment due to inadequate storage areas for live storage. The adoption of storage techniques mentioned above will greatly enhance 'storage of completed and uncompleted projects.

Security of Workshop Facilities

Adequate security for workshop equipment and tools is very essential to prevent these facilities from being stolen or careless losses. One measure of security, according to Okorie (2000) is that big machines in the workshops are usually secured to the floor in order to be firm and devoid of vibrating when the machine is in use. Okorie further stated that fixing these machines to the floor also serves as a security mechanism. The machines are normally placed in particular positions in respect of their functions. Moveable machines, especially portable power tools are permanently kept in stores only to be collected when needed for use. Okorie stated that machines are normally housed in the workshops and entrances to the workshops are Usually protected with burglary proofs made from iron bars. In addition, warning inscriptions are usually hung on each machine to alert individuals of the dangers'of machines.

Experience has shown that such inscriptions are equally security measures to unauthorized individuals who may like to tamper with the machines. It is imperative that technical staff should ensure that both moveable and immoveable machines in industrial technical education workshops are adequately secured. This is to prevent losses or theft of tools needed for instructional activities in the workshops.

Seal and Goltz (1975) stated that tools loss can be kept to a minimum if the rooms are designed in such a way that the teacher can see all parts of the laboratory from one vantage point. Obviously, open tool panels permit the instructor to check all tools rapidly at the close of each work period. Materials storage is done in a secured location easily monitored by the instructor from his classroom.

Okorie (2000) opined that another measure of ensuring security of tools is to keep tools in shelves in accordance with their functions or in tool boxes with keys affixed. Such shelves or boxes are placed right inside the stores. Normally, stores are reinforced rooms in a designated part of the workshop or in a separate building. The store officer in charge is responsible for the security of tools under his custody. Tools are signed out to individuals during working hours in the shop and signed in after workshop periods. Another dimension to security of tools according to Ogwo (2003), is that a tool foreman is usually assigned the task of tool checking at the end of each period. Tools missing on the panels are promptly reported by the tool foreman at the end of the period. Missing tools are usually located quickly since report is made while the class is still present. Furthermore, a simple solution to tool loss according to Ogwo, is the use of a tool loan slip which fixes the responsibility for the return of borrowed tools. In case of failure to return the tool, the shop instructor will have a definite record to the location of the tool and the individual responsible for its return.

Conclusion

Proper storage of tools and materials using the appropriate storage devices and storage rooms ensures a safe working environment, ease of dispensing of tools and materials and prevents accidents in the workshops. Proper storage helps to keep tools, materials, and students' projects safe and in the best possible condition for effective instructional activities. Installing heavy duty machines on the floor and keeping portable power tools and other hand tools permanently in the stores only to be collected when needed for use prevents losses or thefts of these facilities.

The culture of signing tools in and out during and after workshop periods respectively also serves as panacea to tools losses. Unfortunately, adequate storage areas especially for students' projects and flammable materials are often overlooked in the basic planning of most workshops and valuable laboratory space sacrificed for these projects and other materials constitutes safety hazards. Also, despite the application of tool loan slips currently in vogue in most technical workshops, the inventory of tools in workshops has continued to decline and these constitutes impediments to effective teaching and acquisition of skills by students. The need therefore to explore more viable ways of securing tools in industrial technical education workshops need not be overstressed.

Recommendations

Based on the foregoing conclusions, the following recommendations were offered.

1 Adequate number and sizes of storage rooms should be provided for tools, equipment, supplies and student's projects especially during the expansion of the existing facilities or construction of new workshops.

2 The use of tool loan slips by staff and students should be emphasized and strengthened and either staff or students should be made to replace any tool(s) borrowed and not returned

3 The store officer should be mandated to conduct weekly inventory of tools in the store to be forwarded to the respective heads of department or sections so that missing tools can easily be traced to the borrower for immediate replacement.

4 It is important that rupture-proof and fire-proof containers must be provided for flammable materials, such as solvents, finishes, fuels and lubricants as against the current practice of keeping these materials in the general tool room.

5 Finally, the available storage facilities should be properly utilized to eliminate congestion of tools and materials in the work area, storage in corners, and on the floors of the workshop or under the benches.

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