

REFRIGERATION AND AIR CONDITIONING (RAC) TECHNOLOGY: UNRAVELLING ITS STATUS AT WORK

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Abstract

Being the frontline state university in Central Visayas, Cebu Technological University (CTU) adheres to the 16 theories of Tech-voc training to make the school a replica of the industry. This study determined the status of material resource in refrigeration and air conditioning technology at CTU systems. There were fifty-five (55) respondents randomly selected from different campuses of the university to elicit responses on availability, adequacy and usability of such resources. The material resources of the refrigeration and air conditioning (RAC) technology of CTU are insufficient. Further, it can be inferred that insufficiency is paralleled with the need to upgrade the non-serviceable resources due to obsolescence, propel to produce qualified 21st century technology graduates, who are technologically savvy and globally competitive. And it is strongly recommended that the top management may consider enough budget allocation, to buy new RAC technology sets of equipment, for instructional improvement to boost quality technical and vocational education

Keywords: Refrigeration and air-conditioning technology, material resource, availability, adequacy, usability

INTRODUCTION

In a highly and technologically driven world, advancement of technologies is very much unyielding, progress and development have unabated resonance, and greatness extraordinarily becomes inevitable. Technologies provide the power supply for electricity to generate water, light, air, and other forms of goods vital to human development. When there

are varying problems or crises that hit a particular society, the use of technologies give enough contributions in the elimination of these problems. Thus, whatever it takes, technologies have been always a partner to development in responding to global economic challenges.

Living in the Philippines, as a tropical country in Southeast Asia, is being challenged by a scorching heat more especially during summer; yet, humid temperature in most of the time of the day is a reality, that sometimes affects our attitude towards work and mood that consequently affects our psychological make-up to be cranky or grumpy. Thus, the need for air-conditioning in homes and in the offices is required, in order to maintain a healthy, psychological, and most of all to have a productive life. According to Willis Carrier, the “father of air conditioning”, the definition of air-conditioning is subscribed to any of the following such as: (1) maintaining a suitable humidity in all parts of a building, (2) freeing the air from excessive humidity during certain seasons, (3) supplying a constant and adequate supply of ventilation, (4) efficiently removing from the air micro-organisms, dust, soot, and other foreign bodies, (5) efficiently cooling room air during certain seasons, (6) heating or helping heat the rooms in winter, and (7) being an apparatus that is not cost-prohibitive in purchase or maintenance (ASHRAE, n.d.).

Countries, with high temperature, need refrigeration for food preservation, in order to maintain quality and avoid wasting brought by: contamination, toxicity, and other threats to human conditions, including those places found in middle latitude climates are not also spared on food contamination and food poisoning. The role of refrigeration and air-conditioning with this argument is highly desirable. Bernard Bofo (2014), on his dissertation entitled “Energy Efficiency of HVAC (Heating, Ventilation and Air conditioning) Systems as Princes Quay Shopping Centre Goes Green”, analyzes the systems toward energy efficiency and technology application. After series of comparisons, a new technology has been installed and has found out that its center does not only save on one’s electric bill consumption; but also has lower carbon foot prints, making it green. This is a good discovery for ozone reduction, in order to maintain an ecologically friendly environment.

Such application of refrigeration and air-conditioning technology is one of its major contributions to development, knowing that theories and principles of technology are applied in different aspects in domestic, commercial, and industrial refrigeration. It also includes window type air-conditioner, split type air-conditioner, and centralized air-conditioner units, which are installed and have maximum utilization in different sectors, namely: residential houses, commercial establishments, mega malls, hospitals, industrial companies and even in various kinds of transportations

for land, water, and air. The growth shows the importance of refrigeration and air conditioning in different ways of life. These are indicative with the continuous laboratory experiments of Oak Ridge National Laboratory regarding the roof top units that cools commercial spaces in the United States (Kreider, 2000).

The considerable growth of refrigeration and air conditioning covering a wide range of activities such as living comfortably need practical trainings on different systems in order to improve the trainees' technical knowledge concerning various related equipment. Further, a trainee would practice many of the related operations like: cutting, bending, welding of tubes, and detecting any leak from the refrigeration circuits as well as charging refrigerant to the refrigeration system of different units, such as: drinking fountain, water dispenser, juice dispenser, ice drop maker, cold storage, ice plant, freezer, and the like. A national career based in the United Kingdom describes these activities as works of Refrigeration and Air conditioning technicians and engineers.

Consequently, being a technology center in Central Visayas region, Cebu Technological University trains students to become fully competent in the field of RAC. This is carried out on its curriculum mandated by the Technical Education and Skills Development Authority (TESDA) for educational institutions offering technical vocational courses (RA 7796). The accreditation mandates for the requirements of student equipment ratio including the upgrading and procurement of new tools necessary for the completion of the desired competency are realized with compliance. In order to corroborate such claim, this study then is conducted, in order to look into the status of the material resource of refrigeration and air conditioning technology that work in all the campuses of the Cebu Technological University system.

SHORT LITERATURE OF THE STUDY

Among the 16 Theories of Vocational Education advanced by Prosser & Quigley (1949), on Environment Habits and Irreducible Costs, there exists very important relationship of the study conducted. Vis-à-vis, these environment habits indicate that for vocational education to prosper, the place where the learners are to be taught (university) must be a replica of where these learners work (industry) in the future. Anchored on the very same principle the university must look into how the learners are provided with the tools and equipment where to practice and acquire such skills particularly in refrigeration and air conditioning technology.

Under the program of outcome-based education (OBE), the course outcomes as mapped by the TESDA, clearly; exhibits the parallelism of the tools and equipment that Prosser has indicated on his "Environment Habits".

Support is a necessity for learners to acquire such needed mapped out skills by TESDA's National Certifications (NC I and NC II). These skills or competencies range from basic such as: housekeeping and preparation of tools and material to a more complex installation, troubleshooting and servicing domestic and commercial refrigeration and air conditioning units.

TESDA's competencies are categorized as core competencies such as servicing, troubleshooting and installation, which enable the learners to perform the domains of refrigeration and air conditioning technology in the workplace. These common competencies include preparing tools and material and performance for safety practices that allow the students to visualize the actual work implementation. Lastly, the competencies allow the student-trainees to perform required activities as a team.

Looking into the very essence of the study, assessing the material resources of the university answers the call of the times to contribute for the attainment of Prosser's principle of environment habits, where irreducible cost plays a vital role. To quote the theory: *"While every reasonable effort should be made to reduce per capita cost, there is a minimum below which effective vocational education cannot be given, and if the course does not permit this minimum per capita cost, vocational education should not be attempted."* This means that in order for the university to attain its vision, mission, goals and objectives the material resources must be provided (Inocian, 2013); curriculum must be realigned according to the expected institutional, degree program, and course outcomes using the quadrant modelling of teaching (QMT) (Inocian, 2015).

Being an institution of higher education, CTU implements Commission on Higher Education Memorandum Order (CMO) No. 46 series 2012, which provides quality assurance system for tertiary education, and calls to enhance the existing set up in updating a technology driven vocational education, based on the adaptation of vertical and horizontal typology of competencies (CMO) 46, 2012). The HEIs should provide highly specialized educational experiences to train experts in the various technical and disciplinal areas and by emphasizing the development of new knowledge and skills through research and development. With this, Prosser's principle of environment habits and irreducible costs play an important avenue for the completion of this study.

OBJECTIVES OF THE STUDY

The study determined the status of refrigeration and air conditioning technology at Cebu Technological University. Specifically, it assessed the status of material resource in terms of quality and availability, year of acquisition, and functionality of tools and equipment.

METHODS AND MATERIALS

Research Design

The descriptive method of research was used in the study employing a survey questionnaire adapted from TESDA National Standard Competencies. There were 55 respondents comprising faculty, students and administrative staff from the CTU System. Quantitatively, the collected data were analyzed using weighted mean.

RESULTS AND DISCUSSION

The lists of available equipment and quality tools for continuous operation of refrigeration and air conditioning technology are indispensable. Without these tools, the day-to-day services of providing cooling comfort are compromised – air filters, louvers and air vents could not be cleaned; unit pressure could not be checked. The equipment and tools are **almost zero in quantity** validates with **not available**, which verbally described as **never used**. Simply stated that “there is insufficiency of such tools and equipment, like the non – usable, non – functional”, which are considered disposable or non-useful. Among these non-available tools are the refrigerant recovery machines, service thermometer, and leak detectors which are essential tools for operation and are required by authority, like the Clean Air Act (RA 8749) prohibits the venting of refrigerants into the atmosphere, to prevent ozone depletion. Among all equipment and tools, sixteen (16) of which exhibit a quantity value ranging from 0.06 to 0.55 and still verbally described as **never used**, as these equipment existed more than its property life. For purposes of discussion and demonstration, these tools and equipment are not returned to the supply office anymore; and non-serviceable either to be sold as scrap or recyclables for urban garden use as “refrigerator gardens”. Refrigerator gardening that characterizes the use of discarded dead fridge, its door, back and top covers are removed, made to stand like a real fridge; small potted plants are placed in every layer (Inocian & Nuñez, 2015). They added that once, the fridge’s body is laid on the ground, then the back cover is removed or drilled with wholes for water to drain, garden soil is placed, and vegetables are planted. This is one way to reduce the contribution of solid wastes in junk yards and other areas with insufficient solid waste management.

As analyzed by a statistical package, the values are expressed as ratio between tools to a number of students. Because there is a smaller ratio of tools to students, the existing available equipment/tools reach to an insurmountable level that students believe that these are really **not used**. Such belief is anchored on the assumption that single equipment is shared by 25 students. Also, there are equipment/tools that validate the ratio of more than 1.00 but still are validated as never used. Simply put into RAC parlance,

not even half of the student population in the RAC technology, have touched and used these tools /equipment in actual laboratory or maintenance work. Hence, a felt need is sought to acquire these tools/ equipment in order to answer the primary students' needs for their laboratory or maintenance work, in order to ascribe to John Dewey's "Learning by Doing" principle that students are exposed to involvement in real-life tasks and challenging classroom experiences.

In the acquisition years of equipment and tools, 71% of the tools are rated with 4.78 – 5.00 and verbally describe as none. The average of sixteen (16) equipment and tools such as vacuum pump, acetylene cylinder, refrigerant tank and others fall in the interval 4.21 – 5.00 and are verbally described as none. For clarity purposes it can be markedly interpreted that there is that margin where these equipment and tools have been acquired in various years; but are not being covered in the scoring. It can be inferred that even if these equipment and tools are available in the shop; still there is a need to replace these in the storage, in order to increase the quantity and compensate ageing, in order to encourage students' better performance in RAC.

In terms of functionality of equipment and tools, the average are closer to the value 2.00 which means that there are existing equipment and tools **available; but not functional**. Sometime in the past, these tools/equipment are functional and useful; but not for classes in the present time. The maintenance of RAC units by the university has reached its property life that needs immediate replacement. These tools are stacked and used for demonstration purposes only. The validations of all respondents whether the tool is of use or else placed only in cabinets strictly labeled "*for your eyes only*". Fifty five (55) units of these equipment and tools are validated as non-functional and these equipment and tools are described in zero quantity and has never been used. As the ratio (equipment/tools: students) reaches lesser than 1:5, the student who has not seen and used these tools believes that these do not exist and, therefore; have not been used. In same manner, the validation points out that non-existence also mean non-functional, which is limited only to these aforementioned equipment and tools. Another set comprise 16 units of equipment/tools, which are recorded at the validation average closer to 2.00, is verbally described with "Yes" indicating as functional. Although seen to be functional, there is that margin indicating that the certain units are not functioning as well. The results also convey certain numbers of equipment/tools that are fully functional with mean validation of 1.29-1.35, which is verbally to have said "Yes" to functionality. The fact can never be denied that these equipment/tools are needed in the day to day classes, however; the obsolescence of these equipment/tools connotes a non-functional value. Hence, procurement or

replacement of the same would surely meet the requirement in the teaching-learning process that allows students' hands-on experiences.

MATERIAL RESOURCE OF RAC	\bar{x}	VERBAL DESCRIPTION
Quantity and Availability	1.17	Never Used
Acquisition Year	4.17	16 – 20 yrs.
Functionality	1.82	Yes

SUMMARY TABLE ON MATERIAL RESOURCE STATUS
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The table shows the general validation of status in refrigeration and air conditioning technology teaching and learning on the aspects of material resource in terms of quantity and availability, acquisition year, and functionality. The findings signify that available tools are acquired within 16 to 20 years ago are handed down to the third generation and fourth generation of students, which are already unusable. Further, the need to look into the concrete utilization of these material resources for an efficient delivery of the teaching–learning activities requires immediate attention by the university administrators to ensure efficient and effective technology management.

CONCLUSION

The material resources of the refrigeration and air conditioning (RAC) technology of CTU are insufficient. Further, it can be inferred that insufficiency is paralleled with the need to upgrade the non-serviceable resources due to obsolescence, propel to produce qualified 21st century technology graduates, who are technologically savvy and globally competitive.

RECOMMENDATION

It is further observed that there is a need for the university to coordinate closely with other lead government agencies, such as TESDA and CHED for material resources upgrading and development. And it is strongly recommended that the top management may consider enough budget allocation, to buy new RAC technology sets of equipment, for instructional improvement to boost quality technical and vocational education.

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