PPSAT
Journal of Research & Development

PPSAT Journal of
Research and Development

Preface

I am honored to introduce the first volume of the Puerto Princesa School of Arts and Trades (PPSAT) Research and Development Journal.

This journal highlights the action researches and innovations that have significant implications for school policies, training, curriculum development, and the health and wellness of employees. The research articles included in this journal represent the individual and collaborative efforts of faculty and staff researchers, through the support of PPSAT's Executive Committee.

PPSAT Journal of Research and Development shows how our research initiatives led to the enhancement of a skillspreneurship module, development of evidence-based wellness program for employees, innovative recycling methods of scrap materials, application of artificial intelligence in regular training, and development of a movable welding machine. These researches provided answers to problems that required unique approach and solutions.

I am expressing my genuine appreciation to all the employees who took active participation in the research and development program of PPSAT, particularly those who completed their research commitments for the benefit of the institution, trainees, and other stakeholders.

The institution may have taken quite a long time before the debut of the PPSAT Research and Development Journal. Nonetheless, we would like to assure you that we shall continue to disseminate quality research articles that may benefit the readers in making informed decisions in technical vocational education and training (TVET) and other related matters.

Lorizza Mae P. Gacott, MAEd, RGC
Editor-in-Chief

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Innovating Entrepreneurship Training through Modified Skillspreneurship Training Module

Jean Therese G. Padua

Abstract

This study aimed to develop a qualification-based entrepreneurship module. The study included seven entrepreneurship trainers who attended the TESDA Regional Skillspreneurship Training of Trainers. Anchoring on a design-based framework, the researcher conducted needs analysis, and module evaluation and development. The researcher came up with a practical, relevant and learner-centered module, composed of 10 topics. These are 1) Understanding Basic Concept of Entrepreneurship; 2) Generating a Business Idea; 3) Location Analysis; 4) Customer Profiling/Market Segmentation; 5) Marketing Strategy; 6) New Product Development; 7) Costing and Pricing; 8) Establishing and Planning the Enterprise; 9) Managing Business, and 10) Business Sustainability. Topics are arranged from simple to complex. It focuses on planning and managing, which are both important to sustain the growth of a business.

Introduction

The Philippine society sees entrepreneurship as a reliable means to improve one's economic and social standing (Licaros-Velasco, 2013). The creations and innovations of entrepreneurs can change the way we live and work, improve our standard of living, and create jobs for a prosperous society. It is embodied in the RA No. 10679, known as the "Youth Entrepreneurship Act" that the State to promote the development of young Filipinos whose aptitude and skill in finance and entrepreneurship shall be encouraged and honed through education and specialized training programs. Towards this end, the State shall establish, maintain, and support a complete, adequate, and integrated system of education and training to encourage the entrepreneurial spirit among our youth and support and promote the growth of young entrepreneurs nationwide (www.officialgazette.gov.ph, 2015).

The Technical Education and Skills Development Authority (TESDA), as the government agency that is tasked to manage the skills training and development in the country, recognized the importance of entrepreneurship in the country; thus, it is included in the 14-point agenda of the Director General Guiling Mamondiong to provide skills training for entrepreneurs and family enterprises (TESDA, 2018). TESDA Board approved and promulgated the policy on the institutionalization of entrepreneurship in technical vocational education and training programs through Resolution No. 2017-03 dated February 3, 2017, to pursue and sustain Entrepreneurship Development and related programs that are geared towards enhancing the productive capacity and employability of TVET graduates.

According to the research conducted by Licaros-Velasco et al. (2013), Filipinos see their country as having an environment conducive to entrepreneurship. However, according to Global Entrepreneurship Monitor (GEM) report, the major weakness of the

entrepreneurial ecosystem is the "poor provision of training aimed at expanding and sustaining businesses." As stated, *"While many Filipinos have positive views about the prospect of becoming entrepreneurs because they believe they have the capabilities to match the opportunities and start businesses, their actual capabilities to continue and grow their businesses remain underdeveloped."*

As per Rauh-Bier (2016), the biggest challenge the country faces in promoting entrepreneurship is developing the capability and skills of Filipinos in starting and growing businesses. With that, the private and public sectors are working hand in hand to address the mentioned concern like Bayan Academy and Technical Education and Skills Development Authority. Puerto Princesa School of Arts and Trades (PPSAT), as the only government vocational school in the province of Palawan, offers 21 programs that respond to the needs of the industry. The institution provides three-day entrepreneurship training as value-added competency in each program to develop the trainees' entrepreneurial knowledge and skills. The school believes that it is essential for the socio-economic development of its clientele.

To fully equip trainers with the knowledge and skills in Entrepreneurship, the Bayan Academy and TESDA conducted National Training for Trainers on Skillspreneurship in August 2017. TVET trainers from all over the country attended the skills-based training. The aim of the training is to promote the Entrepreneurship module developed by Bayan Academy and to develop entrepreneurship modules in other qualifications. Qualification is a cluster of units of competency that meets job roles and is significant in the workplace. It is also a certification awarded to a person on successful completion of a course and/or in recognition of having showed competencies relevant to an industry (TM1 Training Regulation, 2011).

The skillspreneurship training encouraged TVET trainers to develop a module that is related to their qualifications. The strategy is ideal for PPSAT trainees. However, the topics and examples in the module that were based in JP Morgan's book are general and too complicated that even trainers hardly understood. In addition, topics only focus on planning a business. With this, the researcher would like to contextualize the skillspreneurship module to fit the needs of PPSAT trainees. She would like to propose a Qualification-based Entrepreneurship Module that will tackle the planning to managing stage of the business. The module will use simple language and examples that are related to the trainees' enrolled program. It will emphasize how trainees can use their newly gained knowledge and skills in entrepreneurship.

This study aimed to identify the trainees' needs related to Entrepreneurship training, evaluate the Skillspreneurship module with trainers' help, and develop the Modified Skillspreneurship module. This innovation would be of great help to enhance the teaching and learning process. It can catch trainees' interests/ attention and maximize the training time for they can easily relate to the topics for lifelong learning. And last, it will provide the institution a new strategy in delivering practical entrepreneurship training.

Methods

The researcher used design-based research. This design commonly employs a systematic yet flexible method, through analysis and planning and development, a collaboration between researchers and practitioners (Sudarwati, 2013). The participants of this study were 7 trainers from Puerto Princesa School of Arts and Trades who attended the Regional Training of Trainers on Skillspreneurship. Data were gathered through interviews and surveys. First, trainers identified the training needs of the trainees regarding

entrepreneurship training through observation. Second, trainers evaluated the Skillspreneurship module provided by the Bayan academy. And last, the researcher gathered information from the trainers. Gathered information served as the basis for developing the qualification-based module. The research paradigm below shows the development of the Modified Skillspreneurship Module.

Figure 1
Framework in Developing Modified Skillspreneurship Module
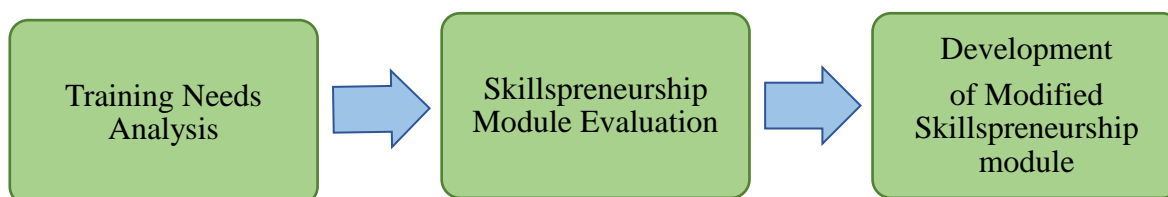
Results and Discussion

This section discusses the training needs of the trainees with it come to Entrepreneurship trainers, the evaluation of trainers to Skillspreneurship module, and the development of the Modified Skillspreneurship Module.

Trainees' Needs Analysis

Clients of TESDA PPSAT vary in educational background and social status. The institution is giving skills training that would meet the needs of the industry. After the skills training, the institution is giving 3 days of Entrepreneurship training to prepare trainees for self-employment. Hence, to realize the objective of this training, trainees' needs should be identified first to assure that the instructions suit the needs.

First, all trainers observed that trainees need instruction that is in line with their qualification so they can easily relate with it. Second, six out of seven trainers (86%) agreed that trainees need a clear, concise, and understandable module where simple and practical topics are given so they would grasp the essence of the course. Third, most of the trainees are not business-minded or don't have experience in business, thus, trainees need a module where basic and detailed instruction is also given and the examples in every topic are simple and attainable. Fourth, trainees need a module where topics start from simple to complex and arrange per the procedure in the business world. Finally, the content in the module should not end on planning but also on managing.

Module Evaluation

The Skillspreneurship module by JP Morgan is composed of the following topics 1) opportunity seeking, screening, and seizing 2) customer profiling and location analysis 3) quality, delivery, price 4)enterprise delivery system 5)human resource management 6)Accounting and finance that tackles about Bookkeeping, templates of income statement/ balance sheet/ cash flow/ funds flow, budgeting and programming and reviewing and 7) establishing and planning the enterprise.

After a thorough review and evaluation of Entrepreneurship trainers to the skillspreneurship module of Bayan Academy, all of them mentioned that the topics in the module should be modified to suit the needs of the trainees. First, the topics in the module are not practical. Second, the module is highly theoretical. And lastly, the topics, examples, and videos apply to college students who are taking business-related courses. Trainees will find it boring, for it is difficult to comprehend.

Trainers suggested that the topics, videos, and examples in the module should not only be related to the qualification but also be viable to the trainees. The type of business introduced should be on a micro-scale level that involves small investments to make it more realistic and attainable. They also suggested using other references that are more understandable. And lastly, videos should be updated and must be relevant to the topic.

Module Development

After analyzing the needs of the trainees regarding the entrepreneurship course and after evaluating the module of skillspreneurship, the module entitled "Modified Skillspreneurship Module" was developed. Topics are arranged from simple to complex and according to the flow of establishing the business. It focuses not only on planning but also on managing, which is very important to sustain its growth. The following figure shows the content summary.

Figure 2
Content of the Modified Skillspreneurship Module

Qualification-Based Entrepreneurship Module

TOPIC 10
Business Sustainability

TOPIC 9
Managing Business

TOPIC 8
Establishing and Planning the Enterprise

TOPIC 7
Costing and Pricing

TOPIC 6
New Product Development

TOPIC 5
Marketing Strategy

TOPIC 4
Customer Profiling / Market Segmentation

TOPIC 3
Location Analysis

TOPIC 2
Generating a Business Idea

TOPIC 1
Understanding Basic Concept of Entrepreneurship

Introduction
General Objective

The changed module is composed of 10 topics. The first topic is "Understanding Basic Concept of Entrepreneurship", it discusses the window in the world of self-employment and entrepreneurship definition. Success in entrepreneurship does not depend only on the financial modal, but also on personal action (non-financial stuff) such as skills, the speed of innovation, and the right attitude in making the business decision (Malaya, 2006; Ahn, et al, 2008; Randolph, 2013; Eroglu, O., 2011). This topic also discusses the qualities of a successful Entrepreneur. The second topic is "Generating a Business Idea", it discusses the different types of business, strategy on how to generate own Business Idea, analyze Business Idea and select the best one, Opportunity Seeking, screening and Seizing, and how to do SWOT Analysis.

The third topic is "Location Analysis". This topic discusses how to choose a suitable location for an enterprise through location analysis (location screening and evaluation) and also discusses the relevant location drivers. The fourth topic is "Customer Profiling / Market Segmentation", it discusses the different ways to profile customers and its application and how to segment the market using customer profiling. The fifth topic is "Marketing Strategy", it discusses the different marketing toolkits and the 6P's of Marketing. The sixth topic is "New Product Development", it discusses how to converge creative mind, technical mind, and business mind to develop a new product or service, the factors that need to be considered in product conceptualization and development, determine the steps that need to be taken to have a successful product design.

The seventh topic is "Costing and Pricing", it discusses how to compute cost, mark-up, and selling price. The eighth topic is "Establishing and Planning the Enterprise". It discusses the basic steps in establishing an enterprise and how to write a simple business plan. The ninth topic is "Managing Business", it discusses Record-keeping, Manage Profit, Manage Credits, Manage Inventory, Practice good housekeeping, and customer service. And the tenth topic is "Business Sustainability" which discusses different strategies on how to sustain business growth.

Conclusion and Recommendation

After determining the training needs and evaluating the skillspreneurship module, the researcher finally comes in the following module contents and arrangements: 1) Understanding Basic Concept of Entrepreneurship; 2) Generating a Business Idea; 3) Location Analysis; 4) Customer Profiling / Market Segmentation; 5) Marketing Strategy; 6) New Product Development; 7) Costing and Pricing; 8) Establishing and Planning the Enterprise; 9) Managing Business; and 10) Business Sustainability.

It is recommended that trainers should use the developed module to see its impact and deepen their understanding and master its content; qualified instructors are really important for the development of the students individually (Likoko, 2013). It is also recommended that future research should evaluate the application of the Qualification-based Entrepreneurship Module.

References

(GYBI), G. y. (2012). *Department of Labor and Employment, Bureau of Workers with Special Concern (BWSC).*

Authority, C.-C. C. (2013). *STAR Sari-Sari Stor Training and Access to Resources Handbook.*

Rauh-Bier, N. (2016) *Developing Filipino Entrepreneurs: CASE-BY-CASE.* RTI International. Retrieved from file:///C:/Users/HP/Desktop/DEVELOPING-FILIPINO-ENTREPRENEURS-January-3-2017.pdf

Sudarwati, N. (2013). Developing an INtergrated Module on Entrepreneuship to Improve Ability in Making Business Plan. *International Journal of Business, Humanities and Technology.*

Union, E. (2014). *Entrepreneurship Development Training Manual.*

Padwal SM, Naidu CA. Computerization in Indian Banks and its Training implications. Prajnan 2006; 14(1-4): 309-319.

Likoko, S. et al, 2013, Tutor Competence and its effect on Quality of Teacher Preparation in Emerging Private Primary Teacher Training Colleges in Bungoma Country- Kenya, Journal of Education and Practice, col. 4 nunnber 2, Pp. 95-102.

Trainer's Methodology 1 Training Regulation, 2011

Health Profile and Fitness Preference of PPSAT Employees:
A Basis for Wellness Program Framework

Claudine C. Carbonell and Lorizza Mae P. Gacott

Abstract

Maintaining the health and welfare of employees in an organization is important as it affects the productivity level and success of the institution. The aim of Puerto Princesa School of Arts and Trades to craft a wellness program for the employees paved the way towards the study of the workers' health profile and fitness preference. The study revealed the respondents' common wellness concerns, which include existing medical conditions, job and financial stress, as well as their common coping strategies when facing distress. Fitness goal primarily revolves on practicing healthy lifestyles. They also identified their preferred wellness activities. Implications for work and life balance are highlighted.

Introduction

In the fast-paced and ever-changing world of work, maintaining health and wellness may be quite challenging for many employees. When workers get chronically exposed to unmanaged stress, their immune system might suffer, and this may lead to developing health problems. The more health problems a person has, the more they experience getting absent from work (Doyle, 2007). The more absences, the lesser productivity. Hence, to meet the demands of today's work, it is vital to be fit and healthy.

There are different ways to stay fit and healthy; and among these is proper diet and exercise (Jensen, 2007). The benefits of exercise in the workplace are immense. Studies show that exercise offers flexibility in the company through decreasing absenteeism and enhancing production level (Henderson, 2003). Not only does it improve an organization's efficiency but also the well-being and morale of employees (Wattles & Harris, 2003). Aside from physical benefit such as weight loss, reduced blood pressure and cholesterol level, and decreased risk of diabetes and cancer, it also proved exercise to have positive effects on emotional and mental functioning (Mayo Clinic, 2007). It reduces stress and increases one's level of happiness.

The management of Puerto Princesa School of Arts and Trades (PPSAT) pays great importance to the health and wellness of its human resources. In fact, part of the school's health program is the provision of free health check and advice to employees. Each regular employee may also avail free medical services to clinics and hospitals accredited by Coco Life, the health insurance company that serves the employees of Technical Education and Skills Development Authority (TESDA).

Likewise, to make the workplace more fun and interactive despite the demands of work, the management has conducted a health and fitness activity that includes aerobic exercise through "zumba". It was supposed to be held weekly, on Fridays. The turn-out of attendance for the first two weeks was good, as more than half of the employees joined the activity. However, it was observed that majority of the employees had lost their interest in the proceeding weeks because of a hectic schedule and other priorities. Despite the inability of the employees to join the scheduled fitness programs, there are also times when

all are mandated to partake in civic activities like "Alay Lakad", marathons, walkathons, or fun runs, which require the participants to go an extra mile during dawn.

To encourage employee adoption of healthier lifestyles, wellness program must be under the needs of employees. Fitness programs would provide a timeline of activities for the employees to follow. Designing a program without considering the underlying heath issues and motivations of employees seems quite difficult, as it may not really meet the needs of the participants. Hence, there has to be a basis for designing such a plan.

It is in this context that this study was conducted. This investigation delved into:

- Employees' health profile
- Common health concerns of employees
- Means of coping with health issues
- Common sources of stress
- Means of coping with stress
- Frequency of alcohol consumption
- Frequency of smoking
- Fitness goals
- Preferred health and wellness activities

Methods

The study used a survey questionnaire to gather information from 49 employees of PPSAT. Regular and job order employees answered the survey. The questionnaire is composed of nine close-ended questions, which aimed to provide answer to this investigation.

Results and Discussion

Figure 1
Percentage Distribution according to Age
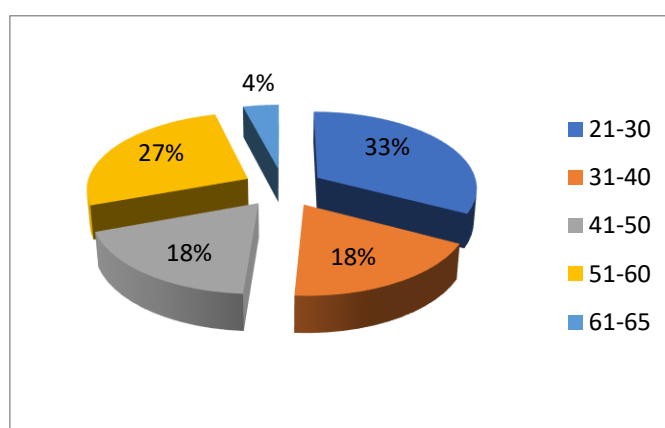
The illustration above shows that the mainstream (33%) employees fall into the age bracket of 21 to 30 years old. This bracket is termed as the early adulthood stage. This is the phase of adult development where individuals are normally active and are often focused on establishing personal and economic independence. They are also focused on developing and maintaining friendship and romantic relationship.

13 or 27% of respondents belong in a bracket of 51 to 60 years old or the last decade of middle adulthood, while only 4% fall in late adulthood or old age. The last phase of middle adulthood involves reaching or maintaining career satisfaction. It is commonly characterized by a decline of physical skills and reassessment of one's priorities. The late adulthood, on the other hand, is the time of adjusting to retirement. It is also characterized by decreasing health and strength.

Figure2
Percentage Distribution according to Body Mass Index
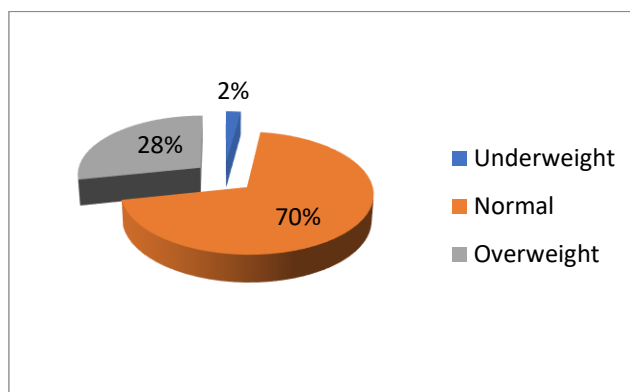
Figure 2 shows that majority (70%) of the respondents have normal weight while the remaining fall under the range of overweight (14) and underweight (1). Body mass index or (BMI) is the measure of weight adjusted for height. It is calculated in kilograms over the square of height in meters (kg/m^2). Though BMI is frequently considered as gauge of body fatness, it is a substitute measure of body fat because it actually measures excess weight rather than the actual excess fat. Despite this, studies have proven that it is related to more direct measures of body fat and future health risks[1]. This means that those who fall within overweight bracket are more prone to future health risks than those with normal weight.

Figure 3
BMI per Age Bracket
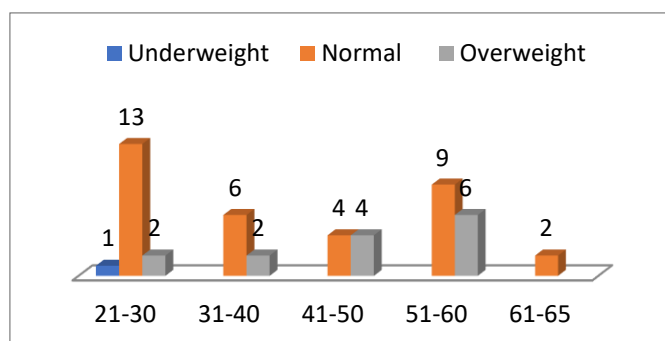
As the study shows, six out of 14 respondents with above average BMI belong to 51-60 years old. Four belong to 41-50 years old.

Figure 4
Preferred Fitness Activities
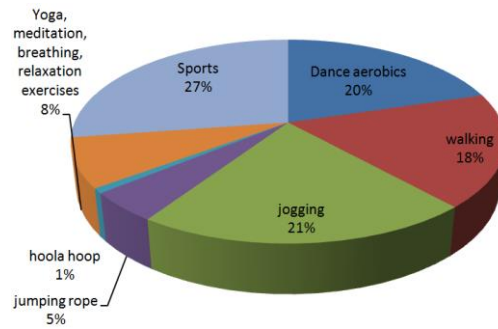
When respondents were asked about their most preferred means of wellness activities, 27% point out sports, followed by jogging (21%). The identified sports activities are basketball, volleyball, table tennis and badminton. It was also observed that as per the age bracket, the more one gets older, the lesser they prefer sports activities.

Figure 5
Fitness Goals of PPSAT Employees

- Lose/gain some weight
- get rid of/manage existing illness
- have robust body & toned and firm muscles
- limit alcohol consumption and smoking
- practice healthy lifestyle
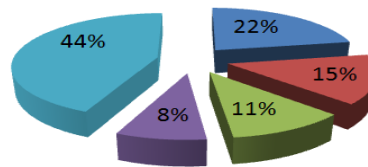
When asked about fitness goals, majority 44% of the respondents admit they want to practice a healthy lifestyle. Healthy lifestyle pertains to proper diet, quality sleep, regular exercise, and effective stress management.

Figure 6
Existing Concerns

The most common problems that bother the respondents are their existing medical condition, stress at work, and financial, mental and emotional stress. It was found out that majority of those who pointed out medical condition belong in the last phase of middle adulthood or those with age bracket of 51–60 years old. They identified the following diseases to be the major cause of their distress: arthritis, hypertension, diabetes, and heart and renal problem. Other identified illnesses are polycystic ovarian syndrome (PCOS) and allergies.

It may not be surprising that work stress is also on top of the list. Many trainers and staff members are assigned to far-flung barangays and municipalities to conduct training and assessment. Some municipalities are not part of the mainland province, and this requires them to travel by land and sea to get there. Employees are also bombarded with workloads that require them to multitask.

Figure 7
Coping with Health Problem
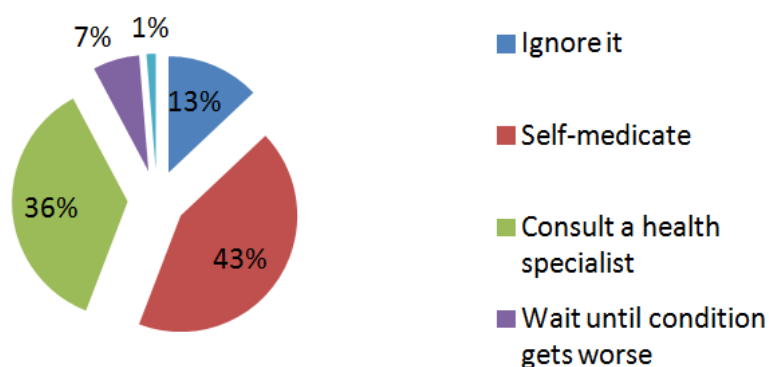
When going through health problems, a great number (43%) of respondents buy and take over-the-counter medicines. The most common meds they take are pain relievers like paracetamol and mefenamic acid. For the respondents, the fastest way to deal with a health problem is self-medicate. Self-medicating occurs when someone takes medication without a doctor's prescription or without the recommendation of a health professional (Fitzgerald, 2016). Though found to be effective in relieving symptoms, self-medicating might actually mask the underlying problem by getting rid of the obvious symptoms. The result also reveals that consulting a health specialist is one of their solutions when facing physical or medical distress.

Figure 8
Coping with Stress

Category	Value
Worry a lot	4.081632653
Procrastinate, be passive and wait	6.12244898
Manage time wisely	10.20408163
Assess the situation and plan for appropriate action	26.53061224
Talk with someone	32.65306122
Do relaxation activities	20.40816327
Sleep a lot	22.44897959
Eat a lot	14.28571429
Exercise	26.53061224
Pray	77.55102041
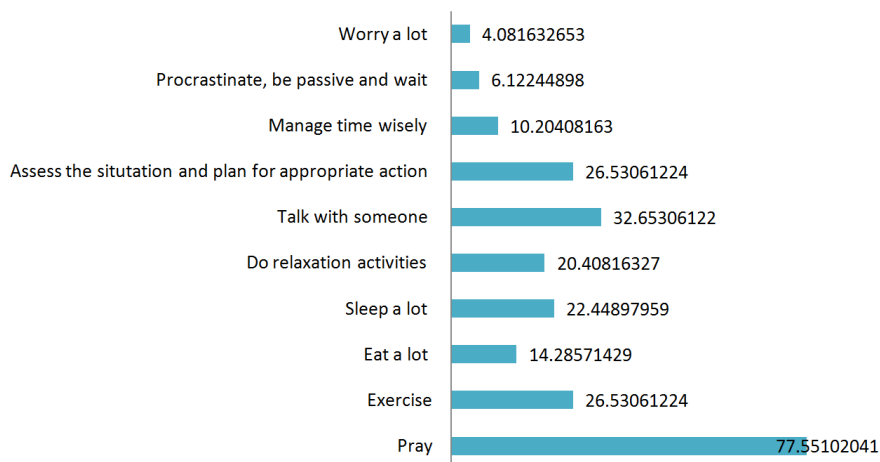
When asked about their top three means of coping with distress, respondents identified praying, talking with someone, and assessing and planning for solution. Very few pointed out worrying, procrastination, and managing time. Their top ways of managing stress are a combination of problem-focused and solution-focused strategies.

According to studies, praying not only improves self-control, trust, ability to forgive but also neutralizes the negative effects of stress (Routledge, 2014). Talking about problems with a trusted person was also found beneficial (Goldsmith, 2011). It is cathartic, especially when done with someone who is comforting and nonjudgmental.

Table 1
Drinking and Smoking Status of Employees

Drinking alcohol	29	60%
Not drinking alcohol	19	40%

Not smoking	44	94%
Smoking	3	6%

Survey reveals that majority of the respondents consume alcoholic beverages. 14 out of 29 said that they only have occasional drinking. A big percentage (94%) claim that they are not smoking. Those who said that they are smoking did not specify the exact frequency of the act.

Studies have shown that moderate alcohol consumption has health benefits like reduced risk of heart disease, ischemic stroke and diabetes. However, moderate use is not risk-free as it can also trigger heart problem and other health issues. Moreover, the effects of smoking and alcohol consumption to productivity and work performance may depend on the consumer's health condition. Less productivity might result when there is absenteeism, anxiety, hypertension, or other diseases triggered by smoking and alcohol consumption (Cable, 2006).

Figure 9
Preferred Style of Exercising
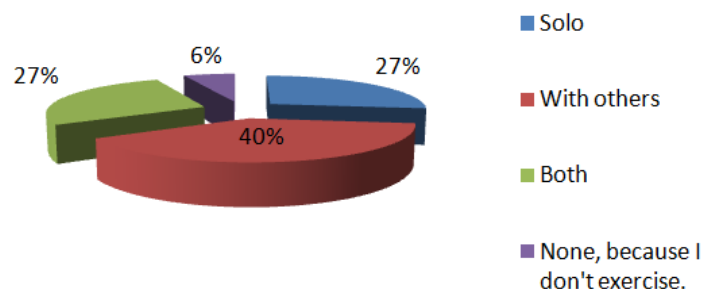
The findings show that 19 (40%) of the respondents favor exercising with others, while there are 13 (27%) who like doing it in solo. Another 27% are fine with either doing it alone or with other people. A part of the group prefers exercising with others because they see it as more fun and engaging. Hence, organizing exercise activities may be supported by social interaction perspective (Kanamori, 2016). The idea of doing it with others may heighten one's motivation to engage in physical activities. Though majority claimed to be enjoying in exercise, there are 6% who do not really exercise.

Figure 10
Commitment to Fitness Program
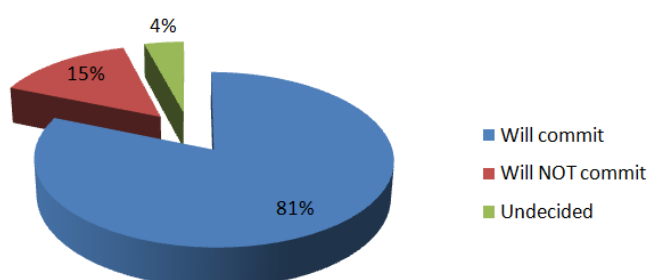
The result shows that majority of PPSAT employees will commit to health and wellness program. On the other hand, seven do not want to commit to any activity related to fitness.

Recommendations

Based on the findings, the following actions are suggested to PPSAT management and other concerned personnel:

1. To increase program participation, provide incentives to participants.
2. Encourage employees to consult health professionals. Regular health appraisals may be considered using the organization's health card (Coco Life)
3. Continuously monitor the weight, blood pressure, blood sugar level, and other health-related concerns of employees.

4. Design a health and wellness program that includes the following activities: jogging, dance aerobics, walking and sports activities. Games may include basketball, volleyball, table tennis, and badminton. It is also important to prepare the materials needed for the program.
5. Holding sports competition may be considered.
6. Conduct talks and lectures on health and wellness. Topics may include stress management, impact of unhealthy lifestyle, preventing and managing chronic illnesses, etc.
7. Distribute workloads equally to avoid overloads and burnout
8. Trainers and staff who travel in far-flung areas must be equipped with medicine and first aid kit.
9. Check the subjective well-being of employees before and after the program to determine the effectiveness of the program

References

Cable, J. (2006). Smokes less productive than non-smoker. Retrieved from http://ehstoday.com/health/ehs_imp_39313

Doyle, B. (2007). 10 reasons to encourage fitness in the workplace. Retrieved from http://www.selfgrowth.com/articles/Doyle4.html

Fitzgerald, K. (2016). Retrieved from https://sobernation.com/what-is-self-medicating-and-why-do-we-do-it/

Goldsmith, B. (2011). Talk about your problems, please. https://www.psychologytoday.com/blog/emotional-fitness/201103/talk-about-your-problems-please

Henderson, R. (2003) Benefits of Exercise in the Workplace
Jensen, M. (2007). Belly fat in men: what you need to know. MayoClinic.com. Retrieved from http://www.mayoclinic.com/health/belly-fat/MC00054

Kanamori, S. *et al*. Exercising alone versus with others and associations with subjective health status in older Japanese: The JAGES Cohort Study. *Sci. Rep.* **6**, 39151; doi: 10.1038/srep39151 (2016).

Mayo Clinic (2007). Exercise: 7 benefits of regular physical activity

Routledge, C. (2014). 5 Scientifically supported benefits of prayer. Retrieved from https://www.psychologytoday.com/blog/more-mortal/201406/5-scientifically-supported-benefits-prayer

Wattles, M. & Harris, C. (2003). The relationship between fitness levels and employee's perceived productivity, job satisfaction, and absenteeism. *Journal of Exercise Physiology Online*.

PVC Pipes Recycling Method in Puerto Princesa School of Arts And Trades: The Innovative Approach

Engr. Rogelio A. Bagona, Jr., Engr. Amiel C. Colendra and Lorizza Mae P. Gacott

Abstract

Plastic wastes are among the top global environmental concerns. In response to the increasing and worsening problems in plastic wastes, the researchers came up with innovative ways of reducing, recycling, and reusing one of the scrap materials in Electrical Installation and Maintenance NC II, the polyvinyl chloride (PVC) pipes. Instead of throwing away the PVC wastes, the innovators turned them into useful hangers and file organizers. The functionality was tested and passed the evaluation of end-users. Improvement in the products' aesthetic appeal needs to be considered. The innovative project has been part of the school's initiative towards greening the campus.

Introduction

Nowadays, there is considerable public concern about plastic wastes. Shreds of evidence show that the negative impact of plastic wastes has run global (Sadlat-Shojai & Bakhshandeh, 2010), as it affects not only humans but the marine and other habitats as well (Thompson, Swan, & Moore, 2009). Plastic wastes emit greenhouse gasses that may lead to ecological damage. Since plastics are usually non-biodegradable, they can linger as waste for a long duration, and hence leaving a detrimental effect on human health and the environment.

Plastic is commonly classified into the following categories: polyethylene (PE), polyethylene terephthalate (PET), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), and expanded polystyrene (EPS). Of these types, PVC is the most commonly used material with low cost and high performance. Because of its high functionality, it is used in the packaging and production of medical devices. Its lifelong duration makes it suitable for construction in a form of pipes, window frames, cable insulations, and many others (Garcia, Balart, Crespo, & Lopez, 2006).

Because of increasing consumption of PVC products, and because of its extremely sturdy nature, with over 100-year lifespan (Jackson & Bertenyi, 2006), it now adds up to the stream of existing wastes in different parts of the world (Sadlat-Shojai & Bakhshandeh, 2010). According to the Waste Policy Case Study of the Australian Department of Sustainability, Environment, Water, Population and Communities, hundreds and thousands of tons of PVC waste are produced. There are two types of PVC waste, pre-consumer waste and post-consumer waste (Brown, Holland, Boyd, Thresh, Jones, & Ogilvie, 2000). Pre-consumer waste comes from trimmings in the factory and recycled in the same place of its production. Since it is not contaminated yet, it is easier to recycle than the post-consumer PVC. The latter represents the discarded PVCs at the end of their practical life. Since most PVC wastes are post-consumer, several ways to deal with the waste issues have arisen.

The disposal method includes landfilling while recycling PVC wastes include incineration and chemical and mechanical recycling. When PVC wastes are sent to landfill, they are buried and covered with soil. Incineration or burning is done to reclaim the energy stored in polymers. In chemical recycling, plastics, which are primarily made of polymers, are degraded to monomers or other basic chemicals, which are then formed into new plastics. Lastly, mechanical recycling includes grinding, sleeving, and screening of PVC.

Moreover, each of these aforementioned methods has benefits and disadvantages (Yarahmadi, Jakubowicz, & Martinsson, 2003; Sombatsompop & Thongsang, 2001; Braun, 2002; Ditta, Wilkinson, Mcnally & Murphy, 2004). Landfilling and incineration are both low cost but generate a very high pollution, hence, non-acceptable. Chemical recycling has a low pollution impact and produces diverse raw materials, but it is costly. Mechanical recycling results in low pollution, and only requires a moderate cost. Having enumerated the pros and cons, the mechanical method earns the highest acceptability over the years to recycle PVCs (Sadlat-Shojai & Bakhshandeh, 2010).

Despite these methods, only a few PVCs are recycled because of the expensive and arduous nature of recycling (Brown et. al, 2000). In countries like Germany, the USA, and Australia, large-scale companies that recycle PVC wastes are common. But unlike these countries, many of the developing nations, including the Philippines, lack industries with well-established recycling systems. Hence, developing countries still rely on low-cost methods like landfilling and incineration. However, as mentioned, landfilling and incineration pose environmental and health risks.

Additionally, the environmental laws and regulations in the Philippines had been implemented to protect the country's environment from different pollution and other hazards that may pose risks to people's health. From 1938 to the present, several laws were executed from the national to the local realm. A few examples of these laws are Presidential Decree (PD) 825 or Garbage Disposal Law, PD 856 or Code of Sanitation, PD 984 or Pollution Control Law, Republic Act (RA) 8749 or the Clean Air Act of 1999, and the most comprehensive and holistic approach, in terms of solid waste management, the RA 9003 or the Ecological Solid Waste Management (ESWM) Act of 2000 (Kojima & Michida, 2011). The latest RA 9003 systematically obliges all agencies to comply with its provisions. Recycling and waste segregation are just a few of its mandates.

Despite the government's thrust for ESWM, there are still a lot of factors that hamper the effective implementation of RA 9003 (Kojima & Michida, 2011) – the leniency of enforcement, the uncooperative attitude of the people, and the lack of knowledge to name a few. Studies show that a high percentage of waste in the Philippines is made of organic and recyclable wastes (Kojima & Michida, 2011). The top waste components are kitchen wastes, paper, and plastic. The top sources are households, commercial establishments, and the marketplace.

In Palawan, particularly in Puerto Princesa City, the daily garbage reached 85 tons in 2014 and doubled to 170 tons in 2015, as reported by the City's Solid Waste Management (Barone, 2015). Aside from households and commercial wastes, an enormous amount of wastes in the city can be accounted to plastic.

Amount of PVC Wastes in EIM NC II Training and Their Management

One of the programs offered in PPSAT is the Electrical Installation and Maintenance (EIM) NC II, under the Construction Sector. The whole program usually runs in a three-month duration of 402 hours and is conducted three times annually. The training comprises Basic, Common, and Core Competencies. It is in core competencies that EIM

trainees immerse themselves in the actual industry practice.

One batch of Electrical Installation and Maintenance NC II is usually composed of 25 trainees. Upon reaching Core Competency, each trainee uses two pieces of PVC pipes, with an individual length of three meters and a diameter of ½ and ¼ inches. This means that each trainee utilizes a total of six meters of PVC pipes in their core competencies. According to Engr. Rogelio Bagona, the lead trainer of EIM NC II, program produces an estimated volume of 400 to 500 kilos of PVC wastes every year. The wastes generated from EIM training are *post-consumer wastes.*

Unlike the used wires that can be recycled or sold to junk shops, PVC pipes are commonly rejected in junk shops. Hence, in EIM training, the PVC pipe leftovers are collected, kept, or disposed of. Most of the time, PVC wastes immediately go to the trash bin and are immediately collected by dump trucks and delivered to a dumpsite at Bgy. Sta. Lourdes.

On the other hand, there is an existing box at the back of EIM workshop that contains the PVC wastes and scrap. However, the waste materials are left untouched. As observed, these poorly managed wastes only become the breeding grounds of mosquitoes, which may pose a negative health impact to the people around the area.

Objectives of the Study

The study aimed to meet the following objectives:
1. Create innovative measures to reduce, reuse, or recycle PVC wastes.
2. Develop file organizer made of PVC scrap.
3. Develop PVC hanger made of PVC scrap.

Significance of the Problem

This study would have significance in terms of recycling PVC scrap, maximizing the use of PVC even after training, decreasing wastage, enhancing the school's green technology, and strengthening PPSAT's 5S implementation. These aim to fortify environmental protection and, at the same time, provide entrepreneurial opportunities.

Research Paradigm

The study followed the input-process-output (I-P-O) paradigm. The input pertains to the data about the use of PVC wastes, the tools, and materials used in the project and the human resources. The process began with the analysis of existing data, designing and developing the project, testing and evaluating, making modifications, and completing the output. The final outputs are hangers and file organizers made of PVC scrap.

Figure 1
I-P-O Paradigm

INPUT

• **KNOWLEDGE REQUIREMENTS**
• Type of PVC used in EIM training
• Frequency of use of PVC pipes
• Quantity of PVC used
• Management of PVC wastes

• **HARDWARE REQUIREMENTS**
• Used PVC pipe ½ & ¾ (scrap)
• Used PVC 20 mm
• Fittings (scrap)
• Tire wire gauge #16
• Solvent cement
• Rivets
• Elbow ½ (scrap)
• Tee ½ (scrap)
• Spray paint

• **HUMAN RESOURCES**
• EIM trainers and trainees
• End-users

PROCESS

• Analyzing Data
• Designing Project
• Developing Project
• Testing and Evaluation
• Making Alterations
• Finalization

OUTPUT

• PVC File Organizer
• PVC Hanger

Methodology

This portion thoroughly discusses the project design, the step-by-step procedure in developing the research projects, the testing and operating procedures, and the evaluation of the end-users.

A. Project Design

The picture of the project's design served as the innovator's guide in creating the project.

Figure 2
Project Blueprint
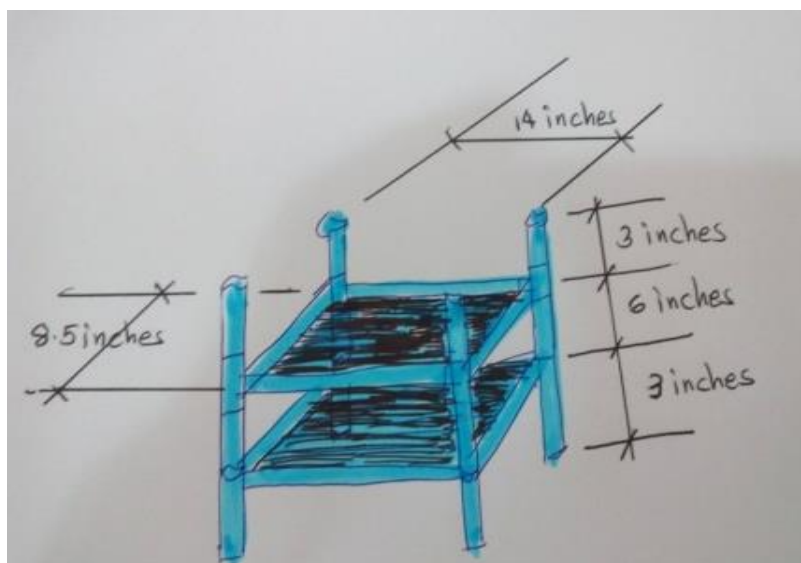
The table below contains the list and specifications of the materials used in creating the file organizer and PVC hanger.

Table 1
List of Materials Used

Unit	Item Description	Qty.
PVC File Organizer		
pc	Assorted lengths of ½ PVC scrap	12
can	Cement solvent (can be used for almost 10 organizers)	1
pc	Rivets	50
pc	½ PVC tee scrap from PLM	8
pc	½ PVC elbow scrap from PLM	4
can	Spray paint	1
PVC Hanger		
pc	Used PVC 20 mm	6
ft.	Used tire wire gauge #16	3

B. Project Development

The following procedures describe the step-by-step process in creating the research projects.

File Organizer

1. Cut and measure PVC scrap. The area measures 8.5 X 14 inches.
2. Assemble PVC pipes with fittings, aligned with the blueprint.
3. Apply PVC solvents and use rivets to connect PVC joints.
4. Apply spray paint and let it dry

PVC Hanger

1. Cut and measure PVC scrap. The length is based on the standard span of 14, 17, or 18 inches.
2. Measure and cut the tire wire gauge. The length has an average of 5-10 inches, depending on the design of the hanger handle.
3. Bend PVC pipe until its curves turn into a regular hanger figure.
4. Drill a hole in the middle of the pipe, enough to insert the wire.
5. Insert the wire in the hole on the middle bottom part of the PVC. Pull until the desired length of the handle is achieved, including the part that needs to be rotated
6. When the desired length of the handle is achieved, rotate the wire to reinforce the handle.

C. Testing and Operating Procedure

The product prototype undergoes preliminary use for testing. Trainees and admin personnel tried and tested the products. They provided feedback to improve the product features. End-users suggested changing the color of file organizers. They also recommend polishing the edges of the PVC hanger to protect clothes from potential damage due to rough edges.

D. Evaluation

To determine functionality and adaptability, a survey questionnaire was administered to the end-users. They rated the product according to functionality and design. Suggestions are incorporated into the finalization of the product.

PVC Hanger

Functionality	Frequency			Total	Percentage (%)			Total
	Trainee	Expert	Colleague		Trainee	Expert	Colleague	
4-Excellent (0% revision)	7	0	0	7	88%	0	0	88%
3-Good (1-25% revision)	0	0	0	0	0	0	0	0%
2-Average (26-50% revision)	1	0	0	1	12%	0	0	12%
1-Fair (51-75% revision)	0	0	0	0	0	0	0	0%
0-Poor (76-100% revision)	0	0	0	0	0	0	0	0%
Total	8	0	0	8	100%	0%	0%	100%

Design	Frequency			Total	Percentage (%)			Total
	Trainee	Expert	Colleague		Trainee	Expert	Colleague	
4-Excellent (0% revision)	7	0	0	7	88%	0%	0%	88%
3-Good (1-25% revision)	0	0	0	0	0%	0%	0%	0%
2-Average (26-50% revision)	1	0	0	1	12%	0%	0%	12%
1-Fair (51-75% revision)	0	0	0	0	0%	0%	0%	0%
0-Poor (76-100% revision)	0	0	0	0	0%	0%	0%	0%
Total	8	0	0	8	100%	0%	0%	100%

PVC Organizer

Functionality	Frequency			Total	Percentage (%)			Total
	Trainee	Expert	Colleague		Trainee	Expert	Colleague	
4-Excellent (0% revision)	12	3	3	18	57%	14%	14%	85%
3-Good (1-25% revision)	0	0	2	2	0%	0%	10%	10%
2-Average (26-50% revision)	1	0	0	1	5%	0%	0%	5%
1-Fair (51-75% revision)	0	0	0	0	0%	0%	0%	0%
0-Poor (76-100% revision)	0	0	0	0	0%	0%	0%	0%
Total	13	3	5	21	62%	14%	24%	100%

Design	Frequency			Total	Percentage (%)			Total
	Trainee	Expert	Colleague		Trainee	Expert	Colleague	
4-Excellent (0% revision)	12	3	3	18	57%	14%	14%	85%
3-Good (1-25% revision)	0	0	1	1	0%	0%	5%	5%
2-Average (26-50% revision)	1	0	1	2	5%	0%	5%	10%
1-Fair (51-75% revision)	0	0	0	0	0%	0%	0%	0%
0-Poor (76-100% revision)	0	0	0	0	0%	0%	0%	0%
Total	13	3	5	21	62%	14%	24%	100%

The analyzed data show the current situation of EIM training in terms of the frequency and quantity of PVC pipe and the management of its leftovers. It was found out that EIM produces a range of 400 to 500 kilos of PVC wastes annually. PVC wastes are kept

or discarded. The project was designed when the trainers brainstormed and came up with a blueprint of the project. The project development transpired during the actual training in Common and Core Competencies wherein trainees had their hands-on experience in EIM. Used PVC materials were collected and formed into useful file organizers and hangers.

The sturdiness of the project was evaluated. File organizers were used and rated by PPSAT admin personnel, trainees, trainers, and experts. The PVC file organizer has a rating of 3.81 in terms of functionality. The initial projects kept their original pipe color, blue and orange. However, the evaluators suggested that the color be changed to improve its aesthetic property.

Hangers were used and rated by trainees, trainers, and experts. It was functional, with a rating of 3.75. The initial projects were functional but still needed improvement in terms of their quality. Rough edges need to be polished to protect clothes from possible tears and damage. After testing, users' feedback was incorporated into the project. Paints were used to improve the product's aesthetic features.

Conclusion and Recommendation

The research project shows the school's initiative in strengthening its greening program through reducing, reusing, and recycling PVC pipes, and turning them into functional file organizers and hangers. The initiative paved the way to the understanding that implementing simple classroom-based research with a minimal budget is not possible, as long as the implementers have a complete picture of how the project will materialize. Despite the successful initiative, it is still recommended that further enhancements be done in terms of the projects' aesthetic features. Aside from improving the products' aesthetics, the possibility of coming up with more unique and functional outputs may be considered. The involvement of trainees in designing the project may also be encouraged.

The Outputs

References

Department of Sustainability, E. W. (n.d.). *National Waste Policy Case Study.* AU.

Ditta, A., Wilkonson, A., Mcnally, G., & Murphy, W. (2004). A Study of the Processing Charaacteristics and Mechanical Properties of Multiple Recycled Rigid PVC. *Journal of Vinyl and Additive Technology*, 174-78.

Garcia, D., Balart, R., Crespo, J., & Lopez, J. (2006). Mechanical properties of recycled PVC blends with styrenic polymers. *Journal of Applied Polymer Science*. doi:101:2464-71

Jackson, S., & Bertenyi, T. (2006). Recycling of Plastics. *IMPEE Project.* University of Cambride.

La Mantia, F. (1996). *Recycling of PVC and Mixed Plastic Waste* . Toronto: ChemTec Publishing.

Nakamura, S., Nakahima, K., Yoshizawa, Y., Matsubae-Yokohama, K., & Nagasaka, T. (2009). Analyzing polyvinyl chloride in Japan with the waste input-output material flow analysis moded. *Journal of industrial ecology, 13*(5), 706-17.

Sadat-Shojai, M., & Bakhshandeh, G. (2010). Recyling of PVC wastes . *Elsevier Ploymer Degradation and Stability* , 404-415.

Thompson, R., Swan, S., & Moore, C. (2009). *Plastics, the environment and human health: current consensus and future trends* . UK: Marine Biology and Ecology Research Centre, Marine Institute, University of Plymouth.

Wenguang, & Mantia, L. (1996). *Post-consumer pipe status.*

Self-Learning Artificial Intelligence for Machine-Based Instruction (SAIMI)

Arnold Leoben A. Campued and Carolyn M. Manga

Abstract

This study aimed to develop a system that could provide immediate machine-guided supervision to Computer Systems Servicing (CSS) NC II trainees during their practical application of skills in the core competency, "Maintain and Repair Computer Systems and Networks". Through the "Waterfall Methodology", the lead trainer's vision to "clone" himself through a machine-based instructional system was realized. The researcher developed a system called Self-learning Artificial Intelligence for Machine-based Instruction (SAIMI) and improved it based on the result of evaluation focusing on three main criteria such as the design and user-friendliness, functionality, and effectiveness of the system as perceived by the trainees of CSS NC II. It is recommended that this system be added to other methods of teaching-learning activities not only for CSS NC II but also for other qualifications to further build trainees' decision-making skills, efficiency, and mastery, and confidence in performing competencies while maximizing the trainers' productivity.

Introduction

The Puerto Princesa School of Arts and Trades (PPSAT) employs a *competency-based training* delivery approach in all its offered programs or qualifications. The CBT approach is guided by ten principles in which all methods of instruction and evaluation are anchored. One principle states that learning is individualized and self-paced. This means that trainees are encouraged to be self-motivated through individualized learning. They learn things in the best effective means possible, and they progress at their rate. This also pushes trainers to plan, collect, use, and employ different ways of learning activities to ensure that trainees achieve their goals according to their learning needs and styles.

Some programs offered by PPSAT are open for enrolment every quarter of the year. One of these is the Computer Systems Servicing NC II, designed to be taken for 280 hours or approximately 3 months. The program has four core competencies, namely: (1) Install and Configure Computer Systems, (2) Set-Up Computer Networks, (3) Set-Up Computer Servers, and (4) Maintain and Repair Computer Systems and Networks.

The lead trainer of CSS NC II, Mr. Arnold Leoben A. Campued, handles three or four batches of trainees every year. A usual batch has about 25 trainees, so this entails a ratio of 1 trainer to 25 trainees. With the continuous thrust of PPSAT to improve the quality and delivery of its training programs, Mr. Campued has noted the need for improved teaching-learning experiences. And one of the strategies is to provide effective and immediate feedback to trainees.

According to Opitz et al. (2011), immediate feedback increases the performance of the students. It is an important part of the assessment process. It has a significant effect on student learning and has been described as "the most powerful single moderator that

enhances achievement" (Hattie, 1999). Since the trainer's feedback in the practical application of skills in CSS NC II session is vital in enhancing the teaching-learning process, Mr. Campued recognized the need to "clone" himself to meet the training objectives within the training duration. He envisioned a program that could do what he can, so that the ratio would be 1:1, to maximize the lessons a trainee could get in the same time. With his skills in information technology, he planned, designed, and executed a system to turn his vision into a functional reality. And so SAIMI was born.

This research project was developed to address the concerns faced by the Computer Systems Servicing NC II lead trainer about delays in trainees' learning experiences caused by his inability to simultaneously attend to the trainees' need for supervision during practical application of skills. The objective of this study is to develop a system that could provide immediate machine-guided supervision to CSS NC II trainees during their practical application of skills in the core competency *Maintain and Repair Computer Systems and Networks*. This is to improve the efficiency of CSS NC II trainees in repairing computer systems and networks through a machine-based learning method.

SAIMI would primarily benefit the trainees by providing them with uninterrupted time for machine-based simulations that are guided and evaluated. This would also benefit the trainer by giving him more time to perform other tasks, thus making him more productive for the institution. Furthermore, by immersing trainees in more troubleshooting mockups, the institution would be able to produce highly efficient graduates who are fit for the industry's needs, thus increasing their employability.

Methods

The *waterfall method* was used; it is a linear sequential design approach for software development, in which progress flows in one direction downwards through the phases of conception, initiation, analysis, design, construction, testing, deployment, and maintenance.

A. Project Design

This part presents all the materials, equipment, and software used in the development of SAIMI from conceptualization until laying down of last touches, with their descriptions and specifications.

Table 1
List of Tools & Equipment Used in Developing SAIMI

MATERIALS USED	CLASSIFICATION	QTY.	DESCRIPTION
1. Laptop Computer	Equipment	1	Xitrix, Intel Core i7 @ 2.40 GHz, 4GB RAM, Corsair Neuron SSD 250GB, NVIDIA GEFORCE
2. Desktop Computer	Equipment	1	Intel Core i5 @ 2.70 GHz, 8 GB RAM, 500GB HDD, NVIDIA GEFORCE
3. External Display Monitor	Equipment	1	AOC 18 inches
4. Digital Camera	Equipment	1	Sony ILCE-5100, 24.3MP
5. Tripod	Material	1	Sony VCT-R640

MATERIALS USED	CLASSIFICATION	QTY.	DESCRIPTION
6. Screwdriver	Material	1	Standard
7. Operating System	Software	2	Windows 7
8. Programming Software	Software	1	Microsoft Visual Studio
9. Photo editing software	Software	1	Adobe Photoshop CS5
10. Text editing software	Software	1	Adobe Illustrator CC
11. Logo and design	Software	1	Windows Presentation Forms

B. Project Development

The innovator identified the problem and need for such a system and he visualized the idea of SAIMI. As soon as the designing phase started, he sought the expertise of a code developer to help in turning the plans and design into a functional system. Both worked together in coding, designing, developing, and bug checking. A flow chart is included to present the course of the project development.

Figure 1
Project Development

Conceptualization
- Planning was done.

Designing
- The main skeletal design of the system was outlined.
- Interactive FX were collected and edited.
- Design and interactive FX were polished.

Content Management
- Resources (BG music, images, etc.) were acquired.
- Scenario-based questions were created.
- Contents were polished.

Coding
- Initial SAIMI flow was coded.
- Content was incorporated into the design.
- Design and codes were finalized.

Initial Execution
- Test runs for SAIMI were performed.
- Initial evaluation was conducted.
- System debugging was done.
- Bug free assurance.

Implementation
- System Deployment

Final Evaluation
- Software evaluation was administered to trainees.
- Employment monitoring carried out.

C. Operating and Testing Procedure

After the last steps of coding, SAIMI was ready for initial execution. This initial execution stage aimed to check for bugs. Forty trainees were asked to test run SAIMI for a week (5days). These trainees were from two sections of CSS NC II in the first quarter of 2017.

Using SAIMI, the trainees were all asked to first undergo 'training' in the *Training Room* before proceeding to the *Assessment Room*. The preliminary levels of their knowledge and efficiency as calculated by SAIMI were recorded as their baseline ratings after undergoing the first training assessment cycle. After 5 days of training, an initial evaluation was done using a self-made evaluation tool to identify points for improvement.

After improving the system based on the result of the initial evaluation, the final test run was conducted. This time, another batch of trainees (46 trainees) of CSS NC II were asked to undergo training and assessment for five days. Using the same evaluation tool, these trainees were asked to evaluate the system afterward.

The ratings of the evaluation in the initial and improved version of SAIMI were compared and employment monitoring was also done to measure the effect of the system on the employability of the users. The result was properly recorded.

D. Evaluation

An evaluation using a self-made instrument was conducted to evaluate the initial and improved version of the system as perceived by CSS NC II trainees. The assessment instrument is composed of 3 key criteria, such as;1) the design and the user-friendliness of the system–whether the system is easy to use or navigate, and if it is pleasing to the eyes; 2) functionality–if the buttons/icons project the correct command, and 3) the effectiveness and impact of the system to the user. Trainees had to rate the design and user-friendliness and functionality using three ratings–3 for outstanding, 2 for fair, and 1 for poor and the effectiveness using yes or no.

Fifteen (15) users of both initial and improved versions of SAIMI were picked randomly to evaluate the system for some improvement. And 80 CSS graduates that are composed of both SAIMI non-users and users were monitored to assess the effect of the system on their employability. A Microsoft excel was used to get the mean and percentage of the data.

Results and Discussion

The following sections discussed the project description and structure, project capabilities and limitations, and project evaluation.
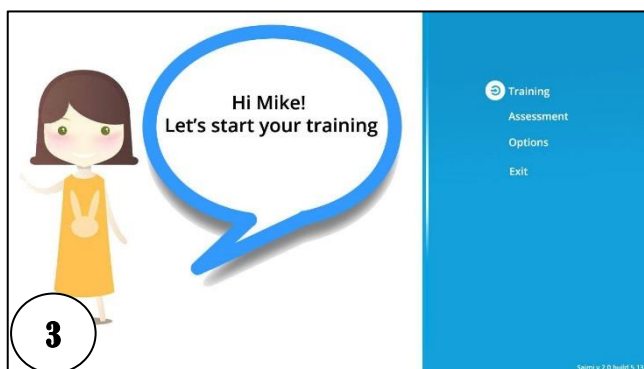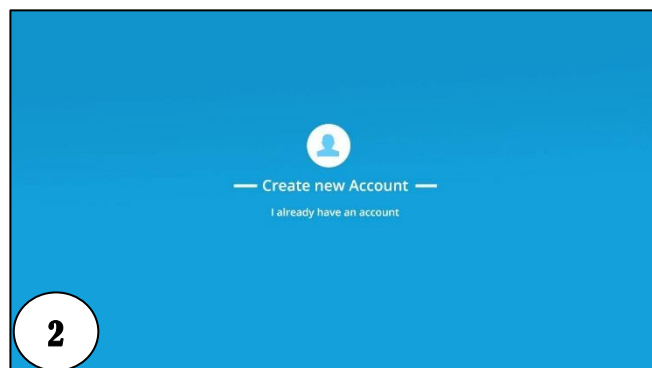
I. *Project Description and Structure*

The final output is the system called Self-Learning Artificial Intelligence for Machine-based Instruction.


Loading SAIMI page...

Sign-up/Log-in page...
New users will create their accounts and those who already have accounts would just need to log in.

Main Screen
On this page, the users may choose to enter 'Training Room' or 'Assessment Room'.

Training Room
Information sheets, task/job sheets, and procedures are available for the users to learn and practice on various learning outcomes.
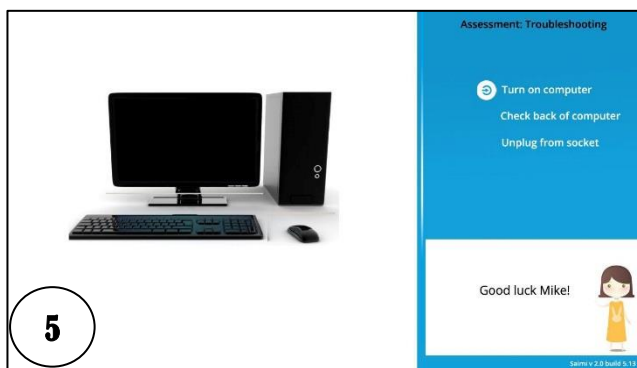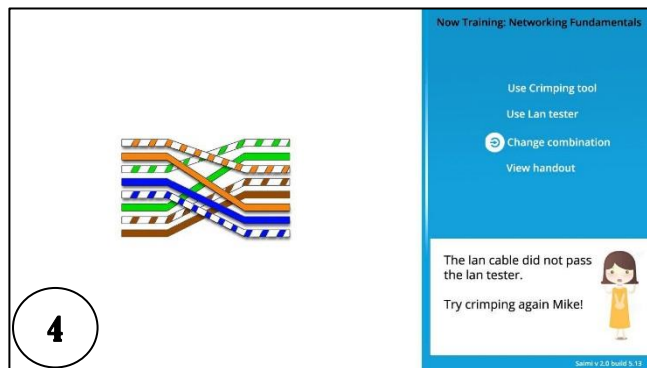
Assessment Room
The users will face different situations and problems that they need to solve. They may choose among steps as shown on the right side of the screen for the moves they would employ for troubleshooting. Every correct procedure increases his/her progress.

Assessment Room
The most efficient process of troubleshooting every problem in the system had been programmed. If a user was able to successfully troubleshoot a problem in the most efficient way possible, corresponding points would be added to his/her progress bars.
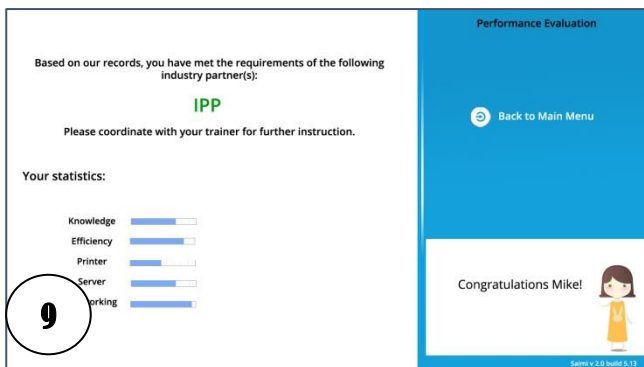
Assessment Room
Users may decide on their process of troubleshooting; many choices are given. But if they do it longer than the programmed 'most efficient process', then deductions will also affect their progress bars.

Assessment Room

Once troubleshooting is successful, feedbacks are given by SAIMI and this feed backing method keeps the system interactively.
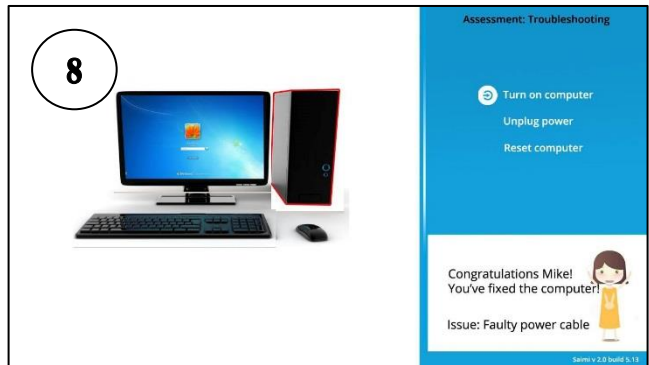
Performance Evaluation

SAIMI provides the user with an evaluation based on their performance.

II. Project Capabilities and Limitations

SAIMI can substitute a teacher during the practical demonstration; it can provide immediate feedback to the trainee's performance. Since SAIMI depends on the input of the trainer, it can only provide limited feedback.

III. *Project Evaluation*

This project has undergone a series of evaluations. An initial and final evaluation and employment monitoring were done to assure the effectiveness and reliability of the system during the training.

Table 2
Comparison of the Initial and Final Evaluation
of the System as Perceived by the Users
(N= 15)

CRITERIA	MEAN OF INITIAL EVALUATION	INTERPRETATION	MEAN OF FINAL EVALUATION	INTERPRETATION
A. Design &User-Friendliness				
1. Ease of program start-up.	2.67	Fair	3	Outstanding
2. System interface.	1.93	Poor	2.6	Fair
3. Program navigation.	2.73	Fair	2.8	Fair
4. Clarity of icons/buttons.	2.46	Fair	3	Outstanding
	2.44	**Fair**	**2.85**	**Fair**
B. Functionality of the System				
1. Command of icons/buttons.	1.73	Poor	3	Outstanding
2. Progress increase in knowledge bar after every assessment activity.	2.46	Fair	2.8	Fair
3. Progress increase in efficiency bar after every assessment activity.	2.73	Fair	3	Outstanding
4. Feedback for incorrect steps.	2.8	Fair	3	Outstanding
5. Feedback for completing tasks correctly.	2.86	Fair	2.8	Fair
	2.51	**Fair**	**2.92**	**Fair**

Legend: 1- Poor   2- Fair   3-Outstanding

As seen in *Table 2*, in the initial evaluation, the respondents rated both the design and user-friendliness, and functionality of the system as fair with the mean of 2.44 and 2.51. With these results, it may be interpreted that the design and user-friendliness of the system still needed some improvement, especially the interface color and the name of the buttons to ensure clearness of commands. In the final evaluation, the design and user-friendliness, and functionality of the system got the mean of 2.85 and 2.92 (both Fair). The ratings in the final evaluation are higher compared to the initial one; it means that improvements were made in the system to meet its objectives.

Table 3
Initial Evaluation of the System Effectiveness as Perceived by the Users
(N= 15)

CRITERIA	FREQUENCY			PERCENTAGE		
	YES	NO	Total	YES	NO	Total
1. The scoring through the knowledge & efficiency bars motivate you to keep going.	15	0	15	100%	0%	100%
2. SAIMI increased your knowledge about maintaining and repairing computer systems and networks.	14	1	15	93%	7%	100%
3. SAIMI increased your efficiency in maintaining and repairing computer systems and networks.	15	0	15	100%	0%	100%
Total	14.7	0.3	15	97.7%	2.3%	100%

Table 3 shows the effectiveness of the system as perceived by the users. From the results, 97.7% of respondents considered the structure of SAIMI motivating for continued learning, and an effective means of increasing knowledge and efficiency for the competency: Maintaining and repairing computer systems and networks. It implies that SAIMI can be a wonderful teaching tool in transferring skills to trainees.

Table 4
Employment Monitoring for SAIMI Non-users and Users.
(N= 80)

CSS Graduates	Frequency	Percentage (%)
NOT EMPLOYED	40	50
EMPLOYED		
A. **SAIMI Non-users**		
o Related to CSS NC II	7	8.75
o Not Related to CSS NC II	7	8.75
Total Non-users employed	14	17.50
B. **SAIMI Users**		
o Related to CSS NC II	15	18.75
o Not Related to CSS NC II	11	13.75
Total SAIMI users employed	26	32.50/ **100%**

This employment monitoring was done to check the employment rate of SAIMI non-users and SAIMI users. Table 4 shows that half (40 graduates) of 80 CSS graduates are employed and out of that employed, 14 (17.50%) are Non-SAIMI users and 26 (32.50%) are SAIMI users. The data implies SAIMI can augment the learning process of the trainees.

Conclusion and Recommendation

Based on the results derived from the project, the following conclusion and recommendation are made:

The lead trainer's vision to "clone" himself through a machine-based instructional system had been realized. His aim to develop a system that could provide immediate machine-guided supervision to CSS NC II trainees during their practical application of skills had been achieved. Based on the evaluation, the system called Self-learning Artificial Intelligence for Machine-based Instruction (SAIMI) was rated fairly by CSS trainees focusing on three primary criteria, design and user-friendliness, functionality, and effectiveness. SAIMI is not only applicable for Computer Systems Servicing but also possible for other qualifications. Although this does not completely replace actual hands-on demonstration of skills, it is recommended that this system be added to other methods of teaching-learning activities to further build the trainees' decision-making skills, their efficiency, and even their mastery and confidence in performing competencies. Also, it is recommended that another study should be conducted to determine the direct relation of SAIMI to the employability of CSS NC II graduates.

References

Bertram Opitz etal. (2011) *Timing Matters: The Impact of Immediate and Delayed Feedback on Artificial Language Learning*

Hattie, J. (1999). *Influences on Student Learning*. Auckland: University of Auckland.

Plan Training Session (2013).*Marikina City: Technical Education & Skills Development Authority National TVET Trainers Academy.*

Appendix

CSS NC II lead trainer, Mr. Arnold Leoben A. Campued providing trainees with a quick briefing about SAIMI.

Trainees trying on the system during the initial execution.

Peer teaching had also been observed.

Users rating the system during the evaluation.

The delivery approach being self-paced, some trainees already tried out the actual hands-on troubleshooting after learning and practicing using SAIMI.

Movable Welding Table with Positioner and Waste Catch Basin

Jovely A. Demaclid and Rebecca A. Edaño

Abstract

The study deals with the creation of a movable welding table with a positioner and wastes catch basin to address the limitations in training facilities and enhance safety in Shielded Metal Arc Welding (SMAW) NC II workshop. Acknowledging the need to provide quality and efficient training without compromising safety, the researchers developed a movable welding table with added features designed to meet the needs of trainees. The innovative equipment was created using the Input-Process-Output framework. Upon the development of the portable welding table with positioner and catch basin using scrap materials, testing and evaluation were carried out. It was found out that the equipment's function and design satisfied the end-users. Moreover, its catch basin and adjustable positioner confirmed a more accessible, safer, and more ergonomic usage as compared to the traditionally designed welding table. It is recognized that the movable welding table with positioner and catch basin will now be able to meet the training and safety needs of SMAW students by showing an operational model that can be used as an auxiliary to the traditional.

Introduction

Welding is one of the most in-demand careers in technology since it provides opportunities for graduates to shift industry without really altering career. Shielded Metal Arc Welding (SMAW) NC II is the program under Metals and Engineering Sector in Puerto Princesa School of Arts and Trades (PPSAT). As per Training Regulations (TR) of SMAW, as crafted by Technical Education and Skills Development Authority (TESDA, 2005), SMAW NC II includes knowledge, skills, and attitudes of a welder per the standards of the industry. SMAW NC II a TVET qualification comprises competencies that an individual must gain to "*weld carbon steel plate and pipe components as specified by layout, blueprints, diagrams, work order, welding procedure or oral instructions using shielded metal arc welding equipment*" (TESDA, 2005). It covers competencies such as Setting-up Welding Equipment, Preparing Weld Materials, Fitting up Weld Materials, Welding Carbon Steel Plates Using SMAW, Welding Carbon Steel Plates and Pipes Using SMAW and Repairing Welds (TESDA, 2005). It has a nominal training duration of 268 hours, covering basic, common, and core competencies as stated in the training regulations.

A lot of clienteles choose to enroll in this program because of the array of opportunities locally and abroad. Graduates of SMAW have career opportunities in manufacturing and construction. They can work locally or internationally as welders, solders, machine setters, operators, and tenders (Nguyen, 2015). The good thing about entering a career in welding is that it does not require a college degree. Instead, employers

look for applicants with a skills training certificate. Ideally, there should only be 25 trainees per qualification that the school must accept to keep the quality of training delivery. Despite the ideal number of trainees, PPSAT gets to accommodate over 25 students per batch in SMAW NC II. The major setback, however, is the limited number of facilities that may hamper practice.

Furthermore, PPSAT adheres to its training delivery on the ten (10) principles of Competency-Based Training (CBT), a result-oriented approach in teaching and learning. One principle is, "*Training is based on work that must be performed."* Hence, trainees are required to have hands-on experience during the training in preparation for the actual world of work. Originally, the practical area of SMAW NC II in PPSAT has been installed with 12 welding booths and two grinding booths. As per TR requirements, SMAW NC II must have a welding booth measuring 1.5m x 2.0m. However, the existing welding booth in SMAW workshop just ranged from 1.2m x 1.5m. The dimensions seem smaller, however.

Moreover, each welding booth accommodates one trainee at a time. Inside the welding booth, an installed 4 cm diameter tubular serves as positioners for practicing skills in welding steel pipes and plates in unique positions. These current built-in booths can easily be filled with clutter and scrap materials that make the area prone to risks, thus possibly affecting the learners' well-being. To make it more conducive to learning, it must be ensured that the area adheres to Occupational Safety and Health Standards.

Likewise, SMAW trainees are trained to perform welding competencies in different positions such as 1F-4F, 1G-6G, 1R, 2R. This is the reason that a positioner in the welding booth is needed. During the conduct of training, SMAW trainers observed that welding flux, electrode butts, iron chips, and small metal craps are commonly scattered on the floor. These are quite difficult to clean and hard to remove. The soiled working area may not be conducive and may also limit the learners' optimum capacity to learn.

There is one lecture room of SMAW that can restfully accommodate a maximum of 25 trainees. On the other hand, the practical area measures 179 sqm, where 12 welding booths, 2 grinding booths, and 3 layout tables are installed. This means that the area can only accommodate 12 learners at a time for practical demonstration, while the others stay on the bench work or layout area. During the core competencies, however, most of the trainees are all in the same competencies. Hence, scheduling is done to give enough time for each trainee to perform in the welding booth. For the past three (3) batches in 2016, accommodated trainees exceeded the ideal number of 25 per block. Instead of passively waiting for their turn, the trainees felt the urge to find a place where they could practice the skills. Seeing the hazards posed by the situation and limited resources, and the need to adhere to the training calendar, the trainers and chairperson of the Metals and Engineering Sector needed to find an alternative so that the safety and quality of training would not be hampered.

In SMAW, the school has successfully adhered to the competency-based training principles except on the principle that encourages individualized and self-paced learning. This principle seems to be hindered by limited training resources and facilities. Despite this situation, the school sees that the quality of training is not hampered. Though this does not negatively affect the acquisition and application of knowledge and skills, as evidenced by a high passing rate in SMAW assessment, the quality of the learning experience and student's satisfaction in training might be compromised. Likewise, the efficiency of training delivery might also be at stake in the long run, if identified problems remain. Hence, the trainers seek feedback from students on identified problems and create alternative solutions.   Aside from adhering to TR in opening and maintaining its training safety and efficiency, PPSAT also makes sure that it observes Occupational Safety and Health

Standards as per set by the Department of Labor and Employment, as amended in 1989 (DOLE, 2016). According to International Labor Standards or ILO, workplaces must protect their workers from sickness, injury, and accidents (Alli, 2008). This does not exempt the schools, especially the TVET institutions, where both trainers and learners must be oriented and capable of promoting and executing OHS practices.

To maintain the quality of training and effective management of resources without compromising OHS, it is in this context that the researchers came up with the research project, movable welding table with positioner and waste catch basin made of scrap.

Objectives of the Study

This project aimed to:

a) fabricate a movable welding table with positioner and waste catch basin
b) test and evaluate its functionality and design.

Research Paradigm

The research project used the I-P-O paradigm. The input contains the knowledge, hardware, and human requirements. The process shows how the research ran, and output indicates the finished and functional product. See the illustration on the next page.

Figure 1
Input-Process-Output Framework of the
Movable Welding Table with Positioner and Waste Catch Basin
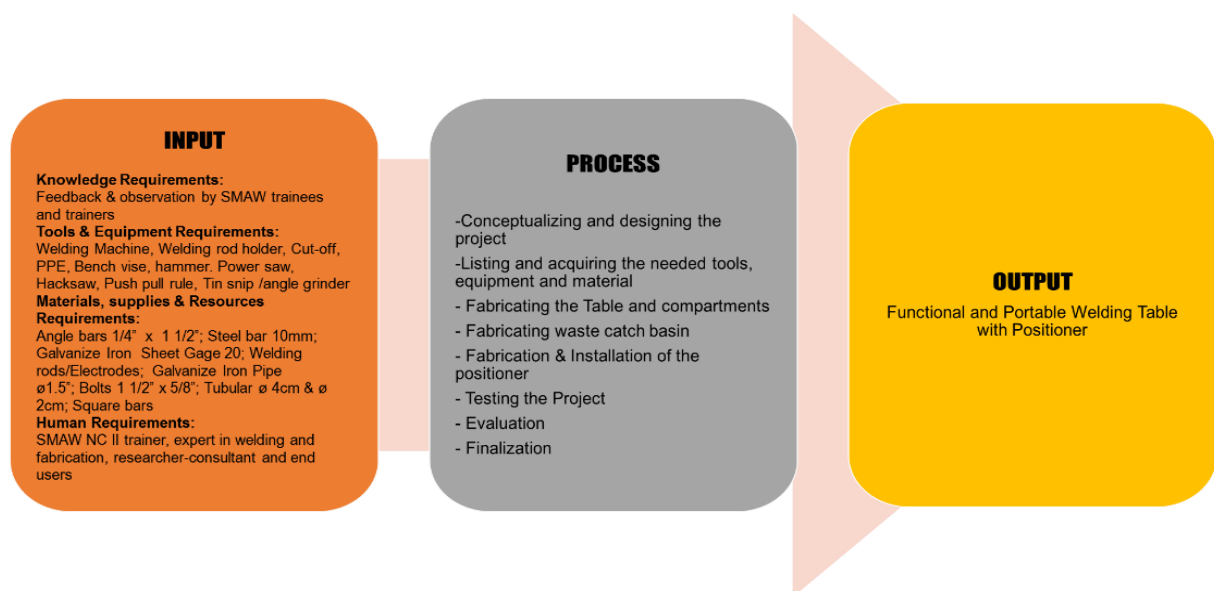
A. Project Design

The materials, supplies, and resources used in the research's development project are as follows:

Angle bars 1/4"x1 1/2"; Steel bar 10mm; Galvanize Iron Sheet Gage 20; Welding rods/Electrodes; Galvanize Iron Pipe ø1.5"; Bolts 1 1/2"x 5/8"; Tubular ø 4cm & ø 2cm;

Square bars

Many of the materials above are recycled scraps, formerly used in SMAW training. These materials were maximized through the use of the following equipment:

Welding machine, welding rod holder, cut-off, PPE, bench vise, hammer, power saw, hacksaw, push-pull rule, and tin snip /angle grinder

The methods of development began with a project design, with the following parts described:

1. *Welding Table and its divisions/compartments/slots*–the base comprised around 90% of the project. Serves as the layout and chipping table, its division holds the welding machine, welding tools, and waste catch basin. It has a total length of 140 cm and a width of 58mcm. The layout area measures 58 x 100cm while separated by a blinder is the space for the welding machine that measures 58 x 40cm. It has catcher slides made of a galvanized sheet that catches directly weld wastes and slides down to the catch basin/ container.

2. *Waste catch basin*—this a rectangular basin made of Galvanized Iron (GI) sheet gage 20 with a size of 27cm x 56cm x 2.4cm, serves as a catcher of welding waste materials, welding flux, electrode butts, small scrap metals and iron chips. As welding waste container, it is removable and allows anybody to pull it out and do the proper disposal, then insert to its slot in the table to be ready to catch another set of welding wastes.

3. *Positioner*– a 94cm-high steel pipe with 14cm diameter, mounted fixed in the table. Connected to it through 1 1/2" x 5/8" bolts are tubular with 4cm diameter that can be moved up and down to adjust the height. Another GI tubular with a 2cm diameter is connected to a 4cm tubular by the same size of bolts. Tighten & loosen the bolts for the adjustments of height, angle, and changing pipes with plates or vice versa. This part is adjustable to satisfy the conditions asked for the welding skills in different welding positions (1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G, 5G, 6G, 1R, 2R).

B. Project Development

1. Fabrication of the welding table.

The needed the materials such as angle bars for the frames and stands of the table, GI sheet for the compartment divisions, and for funnel-like sliding sheet weld under the layout area where welding wastes slides towards the catch basin. Square bars for the grill–like layout area. Below are the steps of fabrication:

- Prepare all materials needed so are the tools then set up the welding machine and accessories.
- Cut the angle bars to produce a frame of desired table size 58cm wide and 102 cm long.
- Weld the angle bars to produce a table frame
- Cut the GI sheet for the divisions /compartments and triangular catch flow.

- Weld to form as shown at the right.
- Cut the square bars of about 20cm long each and weld at the slots in the table's platform (1A)
- Fabricate a compartment for welding machine of about 30cm x 58 cm (1B)

2. Fabrication of Waste catch Basin

- Cut GI sheet to create a rectangular box of 27cm long, 56cm width, and 2.4 cm thick.
- Weld the pieces and fit them in the slot allotted (2A)

3. Fabrication of Positioner

- Cut 94cm long Steel pipe of 14cm diameter, fix in the platform of the table
- Weld the pieces and fit them in the slot allotted (3A)
- Place another pipe of quite larger diameter so that the fixed pipe be inserted into it. Lock with the bolt if the position desired is obtained. (3B)
- Connect a 2m diameter tubular to serve as the workpiece holder (holder of the Steel plate or steel pipe for practice.
- It is now ready to use for practicing steel plates and pipes welding.
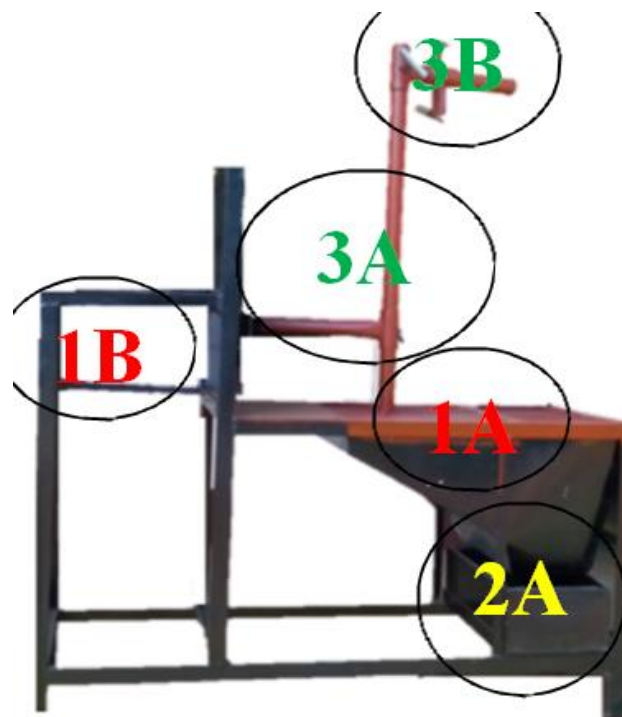
Figure 2
The Developed Parts

Figure 3
Movable Welding Table with Positioner and Waste Catch Basin

C. Operating and Testing Procedure

Part 1: Preparing to weld carbon steel plate

- Wear Personal Protective Equipment.
- Clamp the plates in the movable arbor/holder set.
- Adjust the height of the plate holder set by moving it up down till the desired height and position have been obtained. Lock firmly with the bolt.
- Prepare the welding machine and its accessories.
- Turn on the machine and strike on the plate

Part 2: Preparing to weld carbon steel pipe:

- Wear Personal Protective Equipment.
- Clamp the pipes in the movable arbor/holder set.
- Perform the procedure as in steel plates.

Part 3: Cleaning and wrap up

- Remove the catch basin from the beneath part of the table and dispose

D. Evaluation

The movable welding table with positioner and catch basin was successfully designed and created. The functionality and effectiveness of the product were evaluated by surveying its end-users. The researchers invited experts from Machine shops, such as Salve Rubber and Machine Shop, Universal Engineering and Machine Works, Western

Motors and Machine Works, and Menard Fabrication to test the test and evaluate the project. This group of experts initially observed the demonstration performed by the fabricator-researcher. Then, they performed welding using the movable table with a positioner. Survey forms were distributed after a demo and return demonstration.

Table 1
Functionality of the Movable Welding Table with
Positioner and Catch Basin as Perceived by the End-Users

Functionality	Frequency			Total	Percentage (%)			Total
	Trainee	Expert	Colleague		Trainee	Expert	Colleague	
4-Excellent (0% revision)	18	3	6	27	64%	11%	21%	96%
3-Good (1-25% revision)	0	1	0	1	0%	4%	0%	4%
2-Average (26-50% revision)	0	0	0	0	0%	0%	0%	0%
1-Fair (51-75% revision)	0	0	0	0	0%	0%	0%	0%
0-Poor (76-100% revision)	0	0	0	0	0%	0%	0%	0%
Total	18	4	6	28	64%	11%	21%	100%

Table 2
Design Efficiency of the Movable Welding Table with
Positioner and Catch Basin as Perceived by the End-Users

Design	Frequency			Total	Percentage (%)			Total
	Trainee	Expert	Colleague		Trainee	Expert	Colleague	
4-Excellent (0% revision)	17	4	6	27	61%	14%	21%	96%
3-Good (1-25% revision)	1	0	0	1	4%	0%	0%	4%
2-Average (26-50% revision)	0	0	0	0	0%	0%	0%	0%
1-Fair (51-75% revision)	0	0	0	0	0%	0%	0%	0%
0-Poor (76-100% revision)	0	0	0	0	0%	0%	0%	0%
Total	18	4	6	28	65%	14%	21%	100%

The evaluation revealed that the product received an average of 3.96/4 or 99% in terms of both functionality and design with highly negligible revisions. As per the design, the end-users stated that the equipment is highly ergonomic as the height can be adjusted based on the height of the user, thus, lessening the chance of arm and muscle exhaustion.

Conclusion and Recommendation

The movable welding table with positioner and catch basin was found functional by the end-users. It can be an alternate to the traditional and non-movable welding tables found on the welding booths. The creation of the movable welding table with positioner and catch basin provided an additional venue for trainees in SMAW NC II where they could practice welding skills. Although the research project ended with positive results and feedback, it is still recommended to undergo further improvements. To prove its feature of being a movable welding table, appropriate wheels must be attached to its feet so that it could be easily transferred from one area to another. Moreover, adding cabinet features may also be considered so that the product's functionality could be maximized. After adding such features, it has to undergo again a series of operational testing and evaluation by the trainers, trainees, experts, and other end-users. User's manual should also be created to provide the user with necessary inputs in the proper use and handling of the welding table with positioner.

References

Alli, B. O. (2008) Fundamental principles of occupational health and safety / Benjamin O. Alli; International Labour Office – Geneva: ILO

Department of Labor and Employment (2016). Occupational Safety and Health Standards. Occupational Safety and Health Center, Intramuros, Manila. Retrieved from http://www.oshc.dole.gov.ph/images/Files/OSH%20Standards%202017.pdf

Nguyen, O. (2015). Welding career paths: the ultimate guide to a career in welding. Retrieved from https://www.weldingschool.com/blog/welding/welding-career-paths-the-ultimate-guide-to-a-career-in-welding/

Technical Education and Skills Development Authority (2005). Training Regulations of Shield Metal Arc Welding NC II.

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