Scholarly Technical Education Publication Series

STEPS

Scholarly Technical Education Publication Series (STEPS)

Preface

The Scholarly Technical Education Publication Series (STEPS) has successfully organized its fourth volume which is a collection of curated researches, papers and articles that were selected from hundreds of submissions from all over the region. For this edition, six papers from seventeen authors from different parts of the world namely: Philippines, Malaysia, India, Korea, Sri Lanka and here in CPSC, have showcased their expertise in their respective specializations by sharing their knowledge to a wider audience through this book.

Themes that are featured in this edition include the following: TVET during the Covid-19 pandemic, official development assistance (ODA) in TVET; industry-institution partnerships in the Sri Lankan Context and in the CPSC Member Countries; interactive Courseware Development for Mathematics, Industrial Revolution 4.0, entrepreneurship and the Need for English Language Skills in Academic Life. A technical research paper featuring a Solar Power Generation is also included in this edition's line-up of publications.

Despite the challenges brought upon by the ongoing global pandemic which has largely hindered physical interaction and socialization, we are proud to continue providing relevant publications to the member countries and organizing opportunities for researchers and instructors of TVET in the region to publish their work in a research journal such as this.

I am also pleased to inform you that our own roster of faculty specialists have also contributed significantly to this publication by further elaborating on their chosen field of expertise and by involving the inputs of the CPSC member countries to further enrich and provide information on topics such as industry-institution linkage, entrepreneurship and entrepreneurship.

On behalf of the Editorial Board, I express my sincere appreciation to the authors that are highly motivated and involved in writing these papers. They have expressed professionalism, patience and expertise in their papers, as well as in editing and ensuring that their contributions are in order. We acknowledge and recognize the expertise behind these papers and we wish more opportunities for you to be able to publish your papers for the benefit of future researchers and innovators.

We also appreciate the members of the Editorial Board for painstakingly employed their expertise in academic standardization and copy reading to ensure that each paper complies to the required standards. We also appreciate the efforts in selecting these papers from hundreds of submissions and for communicating to the authors regarding the feedback of their respective peers.

Lastly, on behalf of the Colombo Plan Staff College, we share the aspiration of everyone that were involved in the creation of this publication in pushing for a continued and unimpeded sharing of TVET information despite the global challenges that have affected everyone's lives. I believe that I am saying this for everyone when I say that we continue to be united in our dream for a TVET that is relentless, strong and relevant in weathering the challenges and coming up with the expectations in education and training in today's society.

We hope that you will be able to use the contents of this publication to inform, enrich and appreciate the themes that the authors have highlighted and discussed.

Ramhari Lamichhane, PhD
Editor-in-Chief

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Technical Vocational Education & Training –Reflections on the Issues Facing TVET and Its Potential in the Time of Covid-19

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Abstract

The threat of a global health pandemic called COVID-19 has affected the health of hundreds of thousands of people, claimed lives in many parts of the world, disrupted learning and training, has threatened (and continues to do so) economies and pushed many on the brink of recession. However, it has also pushed individuals and units in the public governance, business, education and communities to think out of the box. Governments are deploying strategies and approaches that they have not implemented before to overcome the crisis. In general, the approaches and solutions that we see today correspond to the preparedness of countries, businesses and communities to tackle the issue on different fronts. The paper makes a reflection of the ongoing issues to throw some light upon how the educational system and TVET should respond to the challenges brought by a global disruption such as COVID 19.

Keywords: Pandemic, Covid-19, TVET

Introduction

The society is facing an unprecedented crisis due to threats of a global health pandemic. At the beginning of 2020, an unprecedented blow due to COVID-19 has affected the health of hundreds of thousands of people. It continues to claim the lives of people in many parts of the world. Perhaps this is the biggest crisis of the 21st century, with a high number of recorded deaths. As a result, there are widespread school closures in many countries. UNESCO reports that 89% of the global student population is affected by the closures, in about 188 countries. More learners could be impacted, according to UNESCO.

In efforts to mitigate the long-term impact of the COVID-19 pandemic, governments have deployed strategies and approaches corresponding to the preparedness of countries to tackle the issue on different fronts.

While this paper does not intend to evaluate the approaches to date, it is good to note how several specific or general measures are put in place to mitigate the impact of this crisis. This impact is observed on society's health, economy, work, education and public life. For example, efforts are in place to promote self-isolation of people at home, social-distancing, the closing of shared frontiers, the strict observance of sanitary measures, the

restriction of some labour activities, accelerated testing, the closing of schools, universities and prevention of social gatherings. All these urgent measures are applied to prevent the worsening of the state of pandemic. However, long-term measures also need to be commenced to manage the serious consequences on the economy, society, culture and education worldwide.

Education and training systems around the globe have started to respond to the situation. Under the circumstances, TVET, an important subset of education and which takes place in secondary, post-secondary and tertiary levels, including work-based learning, continuing training and professional development (UNESCO, 2020 March 29), cannot be a silent spectator. The essence of how TVET can play an important role in the time of crisis, is discussed in this paper.

How TVET Institutions Are Responding To The Crisis

Broadly speaking, the current and potential response of education and training systems can be set up according to their time-relevance. Three perspectives emerge, namely, (1) Immediate response; (2) Medium-term response and (3) Long-term response. In the context of varied developmental structure with specific economic, social and cultural characteristics, the degree of response of institutions is a reflection of the capacity, the readiness of systems and institutional actors, and availability of resources that suit emergency situations.

Immediate Response

By immediate responses, the focus is on the initiatives that are, as of this writing, carried out as temporary alternatives to an otherwise ideal scenario. Initiatives that make use of technology for continuance of learning, use of schools as production units, and make provision for supporting public information and awareness in the community fall in this category.

Firstly, countries strive to bridge the ongoing interruption to the student learning process. A number of institutions and international organisations are making efforts to reach out to learners through online delivery of education and training. Concrete examples are discussed in this paper.

Secondly, TVET schools and training centres are making provisions to supply essential goods and services that are in great shortage. Worldwide, the production of medical equipment and devices has been significantly reduced. A surge in global demand for supplies such as Personal Protective Equipment (PPE) has revealed limited capacity to expand its production (World Health Organization, 19 March 2020). One consequence of it is that the risk of infection for medical workers and for hospital patients increases. To augment the needs, schools and institutions including in TVET have been engaged to produce and utilize their training facilities in the production of needed medical equipment such as protective gears, sanitizers, masks and repair of ventilators, in some localities. This is similar to the concept of 'production school' where practice-based learning in specific trades take place while real goods and services are produced (David, P., 10 April 2020, in World Health Organization, 2020).

Thirdly, some TVET schools take active roles in helping raise awareness on public safety measures to mitigate the outbreak of the virus.

Mitigating Learning Disruption through the Promotion of Online Education

Worldwide, the crisis is dealt with much urgency. Education and training is one of the sectors most affected by the pandemic. It can slow down learning opportunities and impact access to education and training by people that are already in vulnerable conditions and disadvantaged.

The notion that everyone's safety should not be compromised by the need to be physically present in schools and training institutions, demands other modes of delivery of lessons. Hundreds of students and teaching personnel worldwide are trapped in their homes, under self-isolation measures. Hence, learning processes are not taking place the way they would in normal conditions.

According to UNESCO Global monitoring of school closures caused by COVID-195, 188 countries are affected by school closures. As a result, 1.54 Billion learners are unable to attend school and learning activities. The scale of impact is also reflected in the TVET sector. With a sudden halt in normal running of technical and vocational schools and training institutions, students, trainees and apprentices, are systematically unable to continue planned learning and training processes.
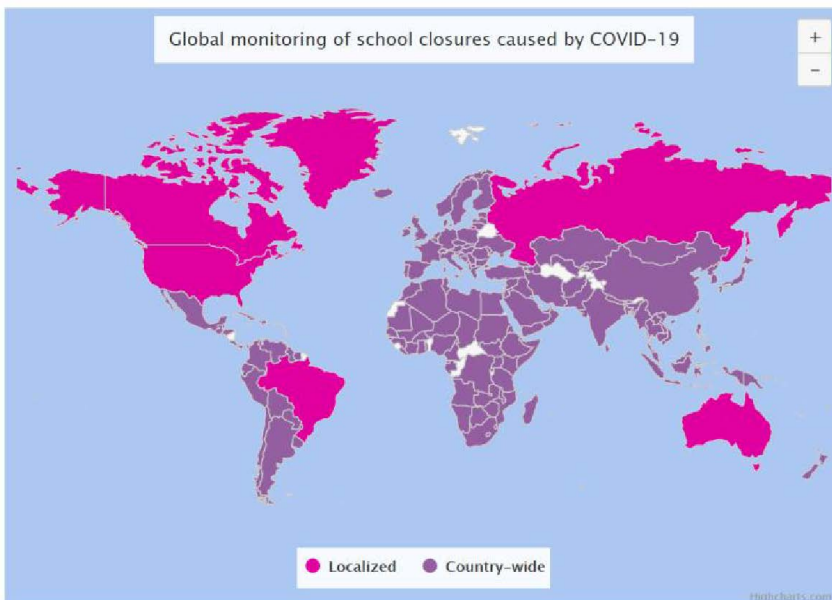
Figure 1: Global monitoring of school closures. Source: UNESCO (2020)

As an immediate response, schools are making available online learning materials and resources as a means to augment efforts and replace modes of delivering contents. This is an immediate solution to mitigate the impact that interruption of the learning process has on students. Virtual classes are replacing in person lessons and work placements of TVET students. Examination and accreditation procedures are being discussed to adapt to the situation and find a way around the established procedures, without hurting protocols and systems.

The priority has been to continue with the learning process without interruption. The degree of efficacy may vary from one country to the other, and even within the same country.

However, this aim is not fully achieved due to some outstanding issues that surround TVET. The process to mitigate learning disruption is hindered by access to the internet and to free and quality web-based tools, poor internet performance in some countries, limited available open online resources and online teaching solutions.

Regarding learning platforms, there are a lot of platforms available for free. However, the highly practical nature of TVET makes them useful only for the theoretical type of subjects. The relevance of the practical part in TVET asks for a solution that goes further away. Use of technology-aided practice-based learning such as the use of virtual simulators is an example. Even if it is true that they cannot be a substitute for real machines and real working environments, they will help in minimising the negative effects of the crisis on TVET students. Still there are some good examples to be drawn from across the globe. For instance, the Technical Education and Skills Development Authority, TESDA, in the Philippines, offers several free TVET online courses through their TESDA Online Programme. This provision has become highly valuable.

The European Commission launched a survey on the 18th of March 2020 and by the 25th of March 21 European Member States and 6 countries from outside Europe answered the survey. Aware of the difficulty to find free materials online for TVET, the Commission is asking European national public authorities to create a free database of existing materials to be shared. There are already some European countries that established such platforms. In Croatia, for example, the Agency for VET and Adult Education has opened a portal and has asked all TVET stakeholders to create and share TVET materials there.

UNESCO and the European Commission are two entities that are responding fast to make available information that can address the need for TVET-oriented materials. Various useful resource databases are shared on their websites (UNESCO, 2020, European Commission, 2020).

UNESCO-UNEVOC, which is coordinating a global TVET network, has recently opened an online discussion thread which encourages TVET providers and stakeholders to share experiences on how they are coping with COVID-19. Similarly, the discussion is open to share contents, to share knowledge, to assist each other and, in the end, to help all the TVET community to give the best possible answer in their specific contexts. Such type of partnership offered through the forum is very timely as it provides a platform to connect information and responses.

The World Federation of Colleges and Polytechnics, a worldwide TVET network, with the same goals as the previous institutions, has also engaged in consolidating and showcasing examples of how colleges are dealing with the crisis through home-grown initiatives (World Federation of Colleges and Polytechnics, 2020).

The World Bank (2020) has several blogs in its webpage to give data based advice on different aspects of online learning. They have organized a call for proposals on March 23 on the topic "Can technology accelerate learning and skills?" Although the call is not TVET specific, it will definitely be an asset to fight the effects of COVID-19 on education. In light of these initiatives, governments, international organisations, TVET providers and individuals alike are in solidarity to create, share, find, communicate and try online learning tools as positive actions. The current situation is also pushing for the creation of more TVET-oriented free and digital education content and resources that can be shared and disseminated widely, to boost self-paced learning.

Making Provision to Supply Medical Equipment and Devices On-Demand

Worldwide, there is a general shortage of Personal Protective Equipment (PPE). One consequence of this is the spread of infection that puts medical workers and hospital patients in great risk. To solve this, TVET institutions are actively engaged in producing protective equipment and other supplies such as sanitizers and masks, which is a timely application of a production school concept within the community. In some communities, repair and maintenance of some equipment that can be used in health facilities are also supported by these schools, in association with industry. The current crisis has pointed to a new opportunity for the TVET system and it is the learners of TVET. It could be an important partner that can bridge education and business to support product and service design, development and distribution. The value proposition that TVET can offer is that it does not only develop students' knowledge, skills and competencies for future work and employment. TVET could also be an effective partner for supporting the production, supply and delivery of goods and services that are normally capital intensive for the business sector. Moreover it can also facilitate practical training.

In this mode, TVET can connect business, community and students who seek for continuance of training, through involvement in business process solutions and innovating their role in the value chain of product and service development and design. Several inspiring interventions linked to this are being led by VET Schools and technical training institutions.

Table 1: Different Responses of TVET in Selected Countries on Covid-19

Country	Response
Spain (Basque Country)	Apart from the general health risk, the COVID-19 crisis has provoked a worrying shortage of critical medical equipment, such as protective facial screens for doctors and nurses. Aware of the need of contributing by all means to the fight against the new virus, the Vice Ministry of Vocational Education and Training of the Department of Education of the Basque Government started to use the technical knowledge and technology of the Basque TVET centres to start producing protective gear for the Basque Healthcare system. 46 Basque TVET colleges are producing two different types of facial screens making use of their knowledge and technology in the fields of paperwork, different materials and 3D printers. Through the initiative, shortages in the supply of medical equipment could be abated and more focus could be given to managing the treatment of patients. On the other hand, the initiative is a perfect example of how, once more, TVET has shown to be a key element of social wellbeing in a country. Furthermore, the initiative could be a source of inspiration to those who are facing similar situations (TKNIKA, 2020).
United States	A team from MIT is engaged in developing an open-source, low-cost ventilator design which is aimed to be shared for free to those who can copy and manufacture these highly critical equipment. This work builds on an earlier work by a team of medical device design students of MIT, which consulted medical professionals in the process of designing and testing low-cost solutions for use in the medical field. The lack of ventilators, and over-reliance on supply of big pharmaceutical industries, currently swamped with unmet demands and limited production, is a pressing issue in many parts of the world. The shortage of these equipment has rendered incapacity for medical facilities to provide the proper care needed by an unprecedented number of populations (MIT, 2020).

Country	Response
Philippines	The country's national technical education and skills development centre, TESDA which is responsible for skill training, certification and establishing training regulations, has mobilized local technical training institutions to help support local needs (TESDA, 8 April 2020). As a result, vocational schools and training centres all over the country have been helping in the production of ready-to-use medical masks and hand sanitizers, which are now helping augment the massive shortage of supply of these important products, and ensuring safety of the medical practitioners and society at large. In addition, several vocational schools in other regions mobilize food and pastry students in supplying food and other basic needs for frontliners in different social units/areas (TESDA, 8 April 2020). The proximity of these institutions within areas where local demand is high, makes it possible to easily deliver the devices to points of emergencies, without having to rely on other services that have also been stalled by the nationwide lockdown (TESDA, 8 April 2020).
Brazil	SENAI, the country's National Service for Industrial Training – a network of not-for-profit secondary level professional school, has teamed up with key industries to establish a coordinated network of service that help maintain unused mechanical respirators or pulmonary ventilators and make them available to treat Covid-19 patients nationwide. This voluntary and free action called 'Respirator Maintenance +Initiative', has been established in 16 states. It was possible to organize this through a strong institution- industry mobilization network in Brazil. This Network is working together to ensure that the shortage in medical equipment is addressed. As an approach, the Network is engaged in sharing technical resources for repair of devices that can be used without having to rely fully on the production of new units, which is affected by disruption in the global supply chain. In addition, the SENAI Innovation and Technology network, a national reference point in Brazil, works round the clock to address the lack of equipment and devices through innovative production (SENAI, 2020).
India	Considering the rising concern of COVID-19 spread in the country, the Indian Institute of Technology, Delhi is committing a total of INR 1 crore worth of High Performance Computing (HPC) Resource for COVID-19 research to merit based proposals selected from a nationwide call. According to the experts, in these difficult times, sharing of resources is important in order to address the infrastructure requirements of researchers working on the Corona epidemic. IIT Delhi has taken a principled stand and wishes to set an example for this. It is important for scientists to collaborate with each other given the urgency of the situation." There are many TVET schools in India that are also engaged in developing protective gears (IIT Delhi, 2020)
Canada	Camosun College makes it possible for trainees to work on campus facilities to aid in the manufacture of washable masks for healthcare workers, using their own tools and equipment available at the College. The initiative is in collaboration with industry partners supplying raw materials, and is managed through the College's applied innovation and research centre in support of the health sector (World Federation of Colleges and Polytechnics, 2020).

Public Awareness Campaign on Safety

Many TVET schools around the world are undertaking a massive awareness campaign. COVID-19 is a newly identified virus. This means that, particularly when it started, only a limited information was available about it. Health organisations, at all levels, have been researching without a break and the world has been gaining more and more understanding about the threat. These awareness campaigns are, and should be, coordinated by relevant authorities from the health sector, but then it is the responsibility of all of us, TVET systems included, to spread their knowledge and contribute to the awareness raising campaigns as much as possible.

Some ideas for TVET institutions are to put posters and infographics in their buildings, to share convenient measures and protocols in their webpages

Figure 2. An infographic material for public safety - Reduce your risk of COVID-19. Source: World Health Organisation (2020)

and social media, and to get in touch with students, parents and companies to make them aware of the situation and to share with them the contents created by the relevant health organisations.

All countries have carried out awareness campaigns. All of them have published some recommendations, have been speaking about it on the media, and have been continuously informing people of the development of the crisis. International organisations have also launched awareness campaigns. Some examples of institutions who worked on awareness raising could be the United Nations, the European Commission, the OECD or the World Bank to name a few. In the TVET sector, UNESCO-UNEVOC is also trying to raise awareness. The network of UNESCO-UNEVOC is composed of over 250 UNEVOC centres in more than 160 countries. Its global presence helps raise awareness to targeted groups. The World Federation of Colleges and Polytechnics, through its members, is also raising awareness. What we, in the end, want to emphasize is that the TVET sector consists of different stakeholders that have a potential access to students, teachers, networks, families and companies and, therefore, should be taken into account for improving the efficacy of awareness raising campaigns at local, regional, national and international levels.

Mid-Term Response

By mid-term response, the focus is on measures that could be taken in TVET institutions to be effectively prepared for any future similar situation and to gradually prepare for any post-pandemic disturbances or opportunities that arise.

The current crisis has rendered interruption not only in school-based education, but also in employment, apprenticeship and other forms of work-integrated learning. The threat of job displacement brought by industry 4.0 and job automation has now been overtaken by fear of massive job displacement in industries affected by the pandemic, or even worse, business closures.

Many trainees/students and workforce are forced out of job, whether it is temporary or full-term, in economies that are unable to buffer the cost of the pandemic to business.

Some of these students/trainees/workers are under reduced work hours, with less pay, disrupted learning opportunities and some, with uncertain immigration status in the case of international TVET students or migrant workers. For example, in Australia, the TAFE Directors Australia has advanced measures to mobilize assistance for students including those in TVET. It has called upon the federal government to safeguard student fees under the Tuition Protection Scheme. It has also called for the removal of delivery and assessment requirements in VET qualifications and access to post-study work given limited possibilities to meet requirements. Some of the innovative measures may be the following:

Repositioning to Support Workforce Retraining

Many migrant workforce sending countries are also bracing for mass return of migrant skilled workers. Looming job displacements will see huge numbers of workforce that need to be absorbed in other jobs or require to be re-skilled or re-trained. ILO data (2018) shows that 32% of the world's current 164M migrant workforce are in Europe, followed by North America and Arab States

Depending on how the pandemic could cause long-term impact to business, TVET institutions will have an important role in addressing unemployment and help in the skilling of local displaced workforce as well as returning migrant workers to seize the next wave of employment opportunity. A serious effort needs to be initiated in the mid-term projections of jobs and guidance and counselling.

Supporting Community-Based Solutions and Strengthening of Local Industries

The COVID-19 outbreak has evidenced that access to medical and other service-oriented facilities is not always easy in an environment where there is controlled mobility, limited flow of services and high reliance on local-based services. Unfortunately, this pattern is establishing a new norm in places where resources are lacking. In some cases, the establishment of local centres might just be the only solution to cut down costs and reduce reliance to non-domestic service providers, which is not plausible in a crisis situation. These are solutions that require medium-term policy strategy.

Community/ or Medical Kiosks, also called "telemedicine kiosk", is an immediate solution that requires medium-term strategy. The availability of these kinds of kiosks can augment the number of service centers that cater to the community during crises. TVET institutions

can be very helpful in expansion of this concept in different localities, in tandem with local community health service providers, to collect community-oriented data and information that can be analysed as a basis for local policy actions and developmental project priorities. TVET expertise could be helpful in deploying technology-enabled applications for managing and maintaining community health databases that are lacking in local health units. TVET can support the development of specific competencies of the local youth to meet the needs of local jobs around the setting up and running, and the delivery of basic medical and non-medical services such as early diagnostics, sample analysis, database recording, equipment repair, and maintenance and community-government-business coordination. These kiosks have the potential to be managed either as a small-scale income-generating enterprise by the community or a philanthropic/civic/public initiative co-managed with private individuals and local government units.

Expansion of facilities that use renewable energy, such as solar energy, is an important initiative that can help in the electrification and better management of remote communities not reached by regular power supply. In times of crisis, the supply of medicines and equipment is scarce. Food supply is heavily disrupted, which creates high demand for local produce and challenges in storage and distribution. TVET can support the training of youth and community to build internal capacities for installation, operation and maintenance of solar-based off-grid devices which are useful in running of temporary health-care units, local laboratories, food dispatch and other service areas for the community that needs electricity supply.

Preparing for Flexible Learning Solutions

Learning disruption has an impact on students' interest with regard to their preferred field of studies. Thus, there is merit in creating solutions to avoid learning disruption and ensure continuance of engagement. Flexible work based learning arrangements deserve special attention in this regard.

It is very common for TVET curricula to have a compulsory part of work placement in the company and there are very different schemes to do that. There has been wide-ranging disruption in TVET student learning within a work-based setting. Most countries have had to stop the company training of their students. It is true, however, that there are countries in which, although the schools are closed, students can continue their work placement if the company is open.

A dual type of training with a very strong company component and the work placement carried out all around the year is harder to apply a flexible approach, especially, in field areas where tasks are simply not possible to be carried out from home. Companies engaging in temporary shifts in production of in-demand products are surely able to cope in a crisis situation, such as what we are learning is happening in France and China. Factory production is shifted to manufacturing of in-demand goods based on similar production chains, and where the available infrastructures are possible to produce them.

As the European Commission and many others have realised, there is a need for TVET specific materials and platforms to be shared and opened to more countries. TVET is particularly vulnerable in a situation where in person training needs to be stopped. TVET students need to practice their skills with real machines and equipment and it is impossible to have them at home. However, the impact of this could be minimised to some extent with the use of free and open source lessons and modules that use virtual simulation.

Even in undisrupted learning conditions, this option has always been an important aspect that schools are encouraged to invest in, especially in cases where there are limited work placements in the company. The crisis has magnified the lack of open and virtual learning simulation materials that can be used by students that are off-work.

Include Pandemic Risk in Planning

The outbreak of COVID-19 has made it evident that TVET systems were not prepared to handle a pandemic situation. They have been, to different degrees and with more or less consequences for students, teachers unable to face the challenges of the current situation.

If we were to ask why it has been like this, the answer will lie in the lack of awareness about pandemic outbreak. In other words, TVET systems have not included pandemics or other similar risk scenarios with global impact that could oblige them to set up new or alternative strategies for delivering education. The Global Preparedness Monitoring Board, World at Risk Annual Report on Global preparedness for health emergencies, has a good explanation how to prepare for health emergencies in future.

Long Term Response

In the long term, COVID-19 has raised fundamental concern regarding the way people live, work, consume and enable development. It has raised serious questions about the understanding of developmental models and basic beliefs about people's relation with nature. The way these challenges and their implications to society is eventually addressed is a reflection of the society's vision of the world it seeks to live in. - Social justice, environment and local development as core principles of TVET learning. By now we are all aware that COVID-19 has originated from the lack of understanding of fundamental issues that society is facing. Globalization has caused inter-dependence and imbalance in the production and supply of global food, medicine and other essential supplies. People's habits and often disregard of others, and other living organisms have highlighted the serious implications and complexities of ecological co-existence. To address this, education and training will need to reinforce training approaches and contents that do not only focus on the technological future, but also help embrace the fundamentals of living in an environment with respect for biodiversity, social justice and cohesion and inclusive development. In this approach, communities and small units of society are enabled to be strong and resilient in any given crisis. Embarking into the path of sustainable development will require a profound transformation in the ways we think, we work, we live and we act; it requires adequate knowledge, skills and attitudes to contribute successfully in the long term. Education and Skills will be the most crucial for transforming the changes to promote the kind of development that people want to see around them.

SDGs as Overarching Principles of Future TVET Development

In 2015 all the members of the United Nations Member States adopted the 17 Sustainable Development Goals and agreed on an ambitious action plan to be achieved by 2030. As the United Nations Organisation point out in their webpage "the Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice.

The 17 Goals are all interconnected, and in order to leave no one behind, it is important that we achieve them all by 2030. People, planet, and prosperity all rely on inclusive societies, a healthy environment and jobs that preserve these aspirations. This is underpinned in the UN 2030 Agenda for Sustainable Development. As countries accelerate their efforts towards achieving the 17 Sustainable Development Goals, there is an urgent need to develop the knowledge, skills and competencies to meet the professional and societal demands, whilst seizing the employment and lifelong learning opportunities offered in the transition to a more sustainable economy and society. TVET institutions in the long run have to play an important role in steering the transition to a low-carbon economy and climate-resilient society.

To facilitate this transformation in a systematic and practical manner, UNESCO-UNEVOC offers a guidance framework for Greening TVET22. The framework sets the scene to undertake TVET reforms in conformity with the SDGs and Education for sustainable development through a whole institutional approach. This approach highlights five dimensions of green transformation in TVET, including Greening the Campus, Greening of Curriculum and training, Greening community and workplace, Greening research and Greening Culture.

Global Citizenship and Peace Education as Central Pillars of Individual Growth

The crisis reminds us that regardless of skin colour, country, culture or size of economy, anyone could be affected by a sudden global pandemic such as what is happening now with COVID-19. We all live in the same world, sharing the same risks. While the world may be increasingly interconnected, human rights violations, inequality and poverty still threaten peace and sustainability.Global Citizenship Education (GCED) is UNESCO's response to these challenges. It works by empowering learners of all ages to understand the global impact of today's issues and that everyone must be on the path to become active promoters of more peaceful, tolerant, inclusive, secure and sustainable societies. Similarly, it is built on the principle of Peace and Human Rights Education. It aims to instil in learners the values, attitudes and behaviours that support responsible global citizenship: creativity, innovation, and commitment to peace, human rights and sustainable development. Schools can act as human resource development centres with values, ethics and traditional culture of peace instead of places of 'congregation' for some defined learning inputs. One example of that is the Basque Country in Spain, where the TVET Vice ministry through their Research Centre, TKNIKA, has launched a programme called 4.0 values.

Stirring Institutions to Innovate and Link with Community Actors

However, the range of responses to COVID-19, as discussed in this paper, represents some solutions that only a limited number of innovative institutions can pull off, many of them have close ties with federal or national interventions, or simply run by committed individuals who are willing to be part of solution tapping the available institutional resources. These types of institutions are however under-represented, or reflect only a miniscule sample of institutions that can systematically play a role if they are supported through top-down governance, and are cut out to initiate innovation amidst crisis situations.

Nevertheless, this limitation is also a strong reflection of the untapped areas that can be further developed into new opportunities. The purpose is to enhance the role of TVET institutions through the following:

i.   Systematic policy development and its enforcement;

ii. Diversification of the learning areas that TVET can support to be able to provide a rapid response to crisis, and

iii. Enhanced role in the skills ecosystem comprising public education and business, and its role in supporting innovation to benefit the local community.

Conclusion and Recommendations

Governments will need to prepare the education and training system and its governance to accommodate opportunities for TVET Institutions to be flexible, to recognize their intrinsic role to the society and economy, as well as allow them to be recognized in the whole skill ecosystem as partners in developing solutions.

All the countries and international organizations should learn from this situation and prepare contingency plans at local, regional, national and international levels to face the challenges of the next pandemic. Partnership and networking will be the key to share and learn from each other.

Education systems should prepare themselves for the long term consequences and take this opportunities to change and reposition education and training for sustainable development.

This paper has offered some points to ponder when planning and governing TVET:

- Pandemic situation and their impact should be included in planning TVET approach and risk management studies,

- Capacity development of TVET teachers need to be strengthened on handling pandemic situation

- Transforming TVET for sustainable development should be the central agenda for future TVET work

- Massive awareness raising is needed to emphasize hygiene measures and the healthy practices among all stakeholders

- Teachers' capacity on developing online education, ethical and moral values and global citizenship be strengthened.

- Students should be provided with the learner centered self-autonomous tools to learn on their own,

- As opportunity dictates, TVET institutions can be leading examples to implement greening approaches

TVET systems are also in a strategic position to think on different time spans when planning their actions and consider short-term (immediate), medium-term and long-term actions.

In the short term, TVET systems should become aware of the fact that they have a huge technical knowledge and, in some cases, well equipped facilities that could be used to help those who are suffering. It is a moral necessity that they start to analyse what they can do and start doing it as fast as possible.

The decision the TVET institutions, people and government take will shape the world for future. It will not only change the health care system but also our future for sustainable economy, social cohesion and environmental integration, the way to think, act and socialize.

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TVET Development and ODA for Developing Countries

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Abstract

The purpose of this paper is to suggest developing plans for developing countries through TVET support and cooperation of Korea ODA. To this end, the concept, history, support system, and the status of Korea's ODA support were reviewed. In addition, an in-depth analysis of the ODA in the TVET field was provided to support developing countries in Korea. Based on these analyzes, the policy recommendations were proposed to coexist with international developing cooperation with developing countries through Korea's ODA in terms of TVET.

Keywords: Official Development Assistance (ODA), TVET, Developing countries, International cooperation

Introduction

Recently, many countries have been increasingly shown their interest in Korea's economic development and TVET success stories. It shares its Official Development Assistance (ODA) experience in TVET development with developing countries and serves as a bridge between developing and developed countries. It has received a lot of aid from several advanced countries, mainly the United States, from liberation in 1945 to economic reconstruction. By the end of the '50s, the United States was a major donor country, and the power of foreign aid was strong behind Korea's continued economic growth. Grant, which began to decline to its peak in 1957, began to be replaced by loan in late 1959.

With the enactment of the Foreign Investment Promotion Act in January 1960, active foreign investment was introduced from developed countries other than the United States and actively implemented along with the establishment of a five-year economic development plan. Korea received about $12.7 billion in aid from 1945 to 1999. In 1995, by becoming a loan graduate of the World Bank, it was virtually excluded from the recipient countries. In 1991, UNDP recognized Korea as a net donor for technical assistance, and it began to fully donor to development assistance.

Korea's ODA was founded in 1987 by Economic Development Cooperation Fund (EDCF) and began to assist the developing countries with concessional loans. Founded in 1991, the Korea International Cooperation Agency (KOICA) has been pushing for grant assistance and technical cooperation in earnest. As an emerging donor country, ODA has been continuously increased to contribute to the development and well-being of developing countries. Its ODA scale continued to increase from $58.74 million in 1991 to $2.4 billion in 2018, ranking 16th among 30 DAC (Development Assistance Committee) member countries.

The purpose of this study is to analyze the experience of ODA on technical vocational education and training (development in Korea. Also, this paper aims to share the best practices of Korea's efficient policies and systems as a bridge between developing and developed countries. The methods for this study analyzed of related literatures and statistical data of government and international organizations.

Research Question, Methodology, and Data

Research Question

The TVET is currently the most performed project among the ODA projects promoted by the Korean government. It is a project that has a great synergy effect of ODA through TVET-linked cooperation. Since support for this will increase in the future, it is necessary to create several modules and provides comprehensive support according to the demanded country.

The paper focuses on the following research question: How will the Korean government promote effective ODA policies in the field of TVET for developing countries.

Method

The methods for this study are analysis of literatures and related data, an expert advisory meeting, interviews with public officials (Asia, Latin America) and experts in the field of TVET at home and abroad, shared research results, and previously held policy debates for verifying the validity of policy recommenda-tions.

Scope And Limitation

The researchers used the annual data for the period 1991-2020, from the Korea International Cooperation Agency(KOICA), Korea Eximbank, and Prime Minister Office. KOICA provides raw data for grant and Korea Eximbank supports for loan in terms of country, region, sector, and type of aid every year. The Prime Minister Office (Committee for International Development Co-operation) annually announces the results of the integrated evaluation of international development cooperation.

There are a few limitations to this study. First, there are time and financial limitations in directly generating national level of ODA-related statistics for TVET in Korea. Second, the ODA statistics in the field of education issued by national institutions are divided into basic, secondary, TVET and higher education. Therefore, there is a limitation to classify TVET out of the total education budget.

Definition, History and TVET Support System of ODA In Korea

Official Development Assistance in Korea

ODA is defined as government aid designed to promote the economic development and welfare of developing countries. Loans and credits for military purposes are excluded. Aid may be provided bilaterally, from donor to recipient, or channeled through a multilateral development agency such as the United Nations or the World Bank. Aid includes grants, 'soft' loans (where the grant element is at least 25% of the total) and the provision of technical assistance. This definition of ODA has been unified since the Organization for Economic Cooperation and Development (DAC) was launched in 1961. ODA can be described with the following three key questions, as shown in Table 1.

Table 1: Three keys in ODA

By whom	Central and local governments of a donor country or other public, international agencies
To whom?	A developing country in the list of ODA recipients, provided by the OECD-Development Assistance Committee(DAC)
How?	Providing grants or concessional loans for the recipient country in order to promote its economic development and welfare improvement

Notes: 1) A grant refers to a 'free' form of assistance in cash, goods, and/or services provided without stipulations of repayment or redemption. Certain types of costs or expenses involved in implementing given projects of assistance may fall into the category of grants. 2) A loan refers to funding provided either in cash or goods with stipulations of liabilities for repayment. Concessional loans made as part of ODA are more favorable to the recipient country than other commercially available loans in terms of interest rates, maturity, and grace periods. In order to count as ODA, a concessional loan must have a grant element of 25% or greater. Source: ODA Korea (2020).

Operating Institution

Korean development co-operation policy sits with the Ministry of Foreign Affairs(MOFA) and the Ministry of Economy and Finance(MOEF) and programmes delivered by their respective implementing agencies, the KOICA for grants and the Korea EXIMbank for concessional loans. Together these two ministries manage around 80 percent of Korea's ODA budget, with the balance spread over a large number of government departments and institutions.

The Committee for International Development Cooperation (CIDC), chaired by the Prime Minister, oversees Korea's development co-operation. The CIDC makes an effort to enhance development effectiveness through better co-ordination across ministries.

The agencies that execute ODAs in Korea can be classified into financial cooperation and technical cooperation institutions according to the type of cooperation in support projects. Korea's institutional framework of ODA consists of a coordinating body, supervising ministries, and executing ministries and agencies.

Korea's ODA is divided into bilateral grant, technical cooperation, bilateral loan, and multilateral grant. Most of the bilateral grant and technical cooperation is carried out through KOICA, a government-funded organization under the Ministry of Foreign Affairs.

However, some government ministries and agencies, such as the Ministry of Education, the Ministry of Science and Technology, and the Ministry of Information and Communication, are also play role in the delivery of Korea's ODA especially for grants and technical cooperation. Entrusted by the Ministry of Strategy and Finance(MOSF), the Korea EXIMbank is responsible for the administrative operation of the EDCF, including appraisal of project, execution of the loan agreements, and loan disbursements. Other duties include principal/interest payments collection, project supervision, and ex-post evaluation of project operations (Korea Eximbank, 2020).

CIDC deliberates and coordinates major policies for Korea's international development cooperation. It established the Country Partnership Strategies (CPS), which designated 24 countries (2016-2020) as the second major ODA partner countries in 2015. Korea's 2016-20 mid-term strategy for development cooperation' aligns with the 2030 agenda for sustainable development. It includes a list of partner countries and identifies policy priorities, including sharing Korea's development experience and building economic and social infrastructure (OECD, 2019). The CPS is an ODA national strategy, including key areas of cooperation such as transportation, education, health and implementation plans. Since the establishment of a CPS for 24 major partner countries, there has been a need to reflect changes such as regime change and the announcement of new development strategies.

In December 2017, the CIDC approved the amendment and supplementation of CPS after interim evaluation in order to enhance its effectiveness as a country-specific ODA strategy, as shown in Table 2

Table 2: Comparison of 2nd ODA Key Partner Countries and Revised Strategies

	Results of Coordination of Key Partner Countries when Establishing the 2nd ODA Basic Plan (Proposal)	Revision of the CPS
Asia	Vietnam, Indonesia, Cambodia, Philippines, Bangladesh, Mongolia, Laos, Nepal, Sri Lanka, Pakistan, Myanmar	Cambodia: Deciding to maintain existing focus areas. Adding a support plan, such as infrastructure construction and policy advisory, to support industrialization, which is the government's strategic goal. Myanmar: Education added as a new focus field at the request of the government. Philippines: Deciding to maintain existing focus fields. Discovering and materializing disaster prevention projects to cope with climate change/protect low-income groups
Africa	Ghana, Ethiopia, Mozambique, Rwanda, Uganda, Tanzania, Senegal	

	Results of Coordination of Key Partner Countries when Establishing the 2nd ODA Basic Plan (Proposal)	Revision of the CPS
Central Asia	Uzbekistan, Azerbaijan	Uzbekistan: Adding regional development, the focus of the new government, as a new focus. Azerbaijan: Deciding to maintain existing focus areas. Addition and materialization of support plans for tourism, SMEs as requested by the government.
Latin America	Colombia, Peru, Bolivia, Paraguay	

Source: CIDC (2015). Activity status and results of CIDC: 21th meeting materials. Retrieved: from: https://. http://www.odakorea.go.kr.(Korean).

ODA Programming Progress

The entire process of ODA programming consists of planning, delivering, monitoring and evaluating, and feedback process in general. In the phase of planning, the mid-term strategy and the CPS provide guidance to executing agencies to design appropriate ODA program for partner countries. Each agency identifies candidate ODA programs through consultation with partner countries and assesses feasibility from comprehensive dimension. Once the executing agencies decide ODA programs to support and establish its business plan for the next year, the CIDC review total ODA programs to prevent overlaps of programs among different agencies and to promote inter-ministerial collaborations for greater efficiency, especially in the same country or region.

For the next step, executing agencies implement ODA programs according to their own procedures, however, all agencies should follow the directions specified in the Strategic Plan such as untying aid, considering cross-cutting issue, and managing for development result. The progress of all on-going programs is monitored at the CIDC level and individual agency level. CIDC established an integrated monitoring system-a one-step-shop database for monitoring the implementation of all Koreas ODA projects built in 2011. By using the database system, each aid agency will input project details such as country, modality, volume, and period and progresses step by step. The system, which will facilitate information sharing and mutual review among development players, will be updated at least every four months or whenever necessary.

Evaluation and feedback is conducted in the middle and at the end of the intervention. There is two-track evaluation system; integrated evaluation and self-evaluation. Self-evaluation is conducted by executing agencies separately and integrated evaluation is managed by the Sub-committee for Evaluation chaired by deputy minister for national agenda of the Prime Minister's Office under the CIDC. For the case of KOICA and EDCF, they have their own evaluation office, guidelines and mid-term and annual evaluation plan, and feedback system, however, most of other agencies don't have well-organized evaluation system so far. The CIDC developed an integrated evaluation mechanism in 2009. The CIDC set 'Guidelines on the Evaluation of International Development Cooperation' and evaluates related policies and project outcomes, based on the Framework Act (Article 13). Under the integrated evaluation system, each executing agency submits its self-evaluation reports to the Sub-committee for Evaluation. Also, this committee evaluates randomly-selected projects to ensure objectivity in its evaluation (ODA Korea, 2018)

Korea's Support Status of ODA in TVET

ODA Form

Grant and loan of development means ODA and other funds. Other funds include other public funds such as export credit and investment finance, private funds such as foreign direct investment, and private grants by NGOs, as shown in Table 3

Table 3: A Comparative analysis of the methods, types and contents of support for development assistance

Classification	Methods of support	Types of support	Contents
ODA	Bilateral	Grant	Donation, technical cooperation, project assistance, food assistance, emergency disaster relief, NGOs support,
		Loan	
	Multilateral		
Other Official Flows	Bilateral	Loan	International agency loans
Private Flows at Market Terms	Multilateral	Loan	Foreign direct investment, export credit for more than one year, international institutional loans, securities investment, etc.
Net Grants by NGOs	-	Loan	Grant by NGOs

Source: CIDC(2017). 2017 Korea's ODA White Paper.

Size of ODA

Korea's ODA has grown steadily since joining the DAC, but ODA budgets and projections remain well below internationally agreed targets. Korea's ODA in 2019 increased by $160 million from the year 2018, due to an increase in bilateral assistance. According to OECD (2019), the combined amount of ODA from the DAC member states stood at $152.8 billion, and the ODA/GNI ratio, the indicator of the level of aid relative to the size of the economy, was 0.30 percent on average. Korea's ODA/GNI ratio was 0.15 percent, a 0.01 percentage point increase from the previous year (0.14 percent). The average annual increase rate of the Korea's ODA from 2010 to 2019 is 11.9 percent, the highest among the member states. The Korea's ODA more than doubled from 2010(US$1.17 billion) to 2019(US$2.52 billion).

Korea was followed by Hungary with 10.5 percent and Germany with 7.0 percent. The largest ODA provider among the DAC members is the United States, followed by Germany. Korea provided US$2.52 billion of ODA in 2019, the 15th largest among the member states of the OECD's DAC(OECD, 2019).

In Korea, among the $2,521 million of ODA, bilateral aid was $1,903 million (75.5 percent) and multilateral aid was $618 million (24.5 percent). The ODA/GNI ratio has increased from 0.14 in 2018 to 0.15 in 2019, The Strategic Plan also projects a steady increase of the ODA/GNI ratio up to 0.20 percent by 2020, by which Korea can come close to the average level of DAC members. Among the bilateral aid, grant is $1,217 million (increase of 7.6 percent compared to the previous year), and the amount of loan that provides the concessional loan is $686 million (increase of 13.7 percent compared to the previous year)

Table 4: Provisional statistics for 2019 Korea ODA (in million dollars)

Classification		2018	2019	Rate of increase and decrease(%)	Percentage(%)
ODA (A+B)		2,358	2,521	6.9	100.0
- Bilateral ODA(A)		1,734	1,903	9.7	75.5
	Grant	1,131	1,217	7.6	(64.0)
	Loan	603	686	13.7	(36.0)
- Multilateral ODA(B)		624	618	Δ1.0	24.5
ODA/GNI(%)		0.14	0.15	-	-

Source: OECD(2020.04.16). Provisional statistics for 2019 Korea ODA

The Strategic Plan is stated to maintain the bilateral to multilateral ODA ratio at 75:25 in parallel with the steady increase in the total ODA volume by 2015. Within bilateral ODA, Grants accounted for approximately 60-70% of Korea's bilateral ODA with slight variations in the past ten years (OECD, 2020).

In 2020, the confirmed amount of ODA is about 3.427 trillion won (KRW) , with a total of 1,551 projects being pushed by 41 institutions. It increased by 226.7 billion won from the fixed amount of 3.2003 trillion won in 2019, up 7.1 percent from a year earlier. Participating institutions are the same as 41 in 2019. The number of projects increased by 147(10 percent) compared to 1,404 in 2019.

Region and Country

Korea has had close ties with Asian countries given its geographic proximity and cultural familiarity. This has been reflected in its concentration of aid allocation to Asia. For instance, Asia received the largest portion of bilateral ODA (approximately 53 percent) during the past ten years.

As part of its commitment to join the global efforts for timely achievement of the MDGs, Korea has increased its allocations for Africa where Highly Indebted Poor Countries (HIPCs) are concentrated, with an emphasis on poverty alleviation and capacity building. The African partners received about 21 percent of bilateral ODA in the past ten years. Others including Central and South America, Middle East and CIS, and Oceania received 19 percent of bilateral ODA in the past ten years. The concentration of bilateral ODA in Asian countries has decreased in last five years, and it was 46.3 percent in 2015. On the other hand, the amount and the proportion of bilateral ODA for Africa have steadily increased, and it comprises 23.9 percent in 2015

Sector

In 2006 and 2015, about 70.2 percent of total bilateral ODA was targeted to social and economic infrastructures development, with a sectoral focus on education, health, and transportation identified as priorities in partner countries' development strategies. In 2017, $970 million (39.7 percent) of bilateral ODA commitments was allocated to economic services, while $903 million (36.9 percent) of bilateral ODA commitments was allocated

to social infrastructure and services, with a focus on transport and communications ($849 million) and health and population ($406 million). Humanitarian aid amounted to $88 million. In 2017, Korea committed $1.2 billion (50.9 percent of bilateral allocable aid) to promote aid for trade and improve developing countries' trade performance and integration into the world economy.

The ratio of bilateral cooperation to multilateral cooperation among the total ODA is about 81 to 19, and the ratio between grant and loan cooperation is 43:57. In 2019, the ratio of bilateral cooperation to multilateral cooperation increased by 3 percent points from 78 to 22. In addition, the ratio of grant and loan cooperation in 2019 was 46 to 54, and the ratio of grant cooperation increased 3 percent point compared to the previous year. In 2017, bilateral ODA was primarily focused on Asia and sub-Saharan Africa. $458 million was allocated to Far East Asia, and $283 million to South and Central Asia. $392 million was allocated to sub-Saharan Africa.

Table 5: Size of ODA by region and type in 2020

Classification		Asia	Africa	Latin America	Middle East/ CIS	Oceania	Etc
Amount (100 million won)	Loan	6,637	2,786	632	769	24	1,000
	Grant	4,291	2,184	1,116	593	131	7,586
	Total	10,928	4,970	1,748	1,362	155	8,586
(%)	Loan	56.0	23.5	5.3	6.5	0.2	8.4
	Grant	27.0	13.7	7.0	3.7	0.8	47.7
	Total	39.4	17.9	6.3	4.9	0.6	30.9

Source: 34th Committee for International Development Cooperation (2020.1).

In 2020, ODA by sctor increased, which was led by transportation (13.6 percent), education (10.4 percent), and health (10.0 percent). The public administration sector's allocation slightly increased by 1.1 percent point as compared to the previous year. This was further illustrated in Table 6.

Table 6: Size of ODA by sector and type in 2020

Classification		Transportation	Education	Heath	Agriculture· Forestry· Fisheries	Industry· Energy	Public Administration	Environment	Humanitarian support	Etc
Amount (100 million won)	Loan	3,427	924	1,171	1,165	1,499	575	1,714	0	1,373
	Grant	337	1,962	1,602	1,569	946	1,753	480	1,677	5,577
	Total	3,764	2,886	2,773	2,734	2,445	2,328	2,194	1,677	6,949
(%)	Loan	28.9	7.8	9.9	9.8	12.6	4.9	14.5	0.0	11.6
	Grant	2.1	12.3	10.1	9.9	5.9	11.0	3.0	10.5	35.1
	Total	13.6	10.4	10.0	9.9	8.8	8.4	7.9	6.0	25.0

Source: Source: 34th Committee for International Development Cooperation(CIDC) (2020.1).

Type

In 2020, ODA by type of support was shown in the order of volunteer dispatch (64.2 percent), training business (included scholarship support (5.7 percent), program (5.5 percent), development program (4.5 percent), and is supported in various forms, as shown in Table 7.

Table 7: ODA by type in 2020

Classification		Volunteer dispatch	Training Business (included Scholarship Support)	Program	Development Consulting	Public-private cooperation	Technical Cooperation	Administration Cost	Etc	
Amount (100 million won)	Loan	10,849	-	-	1,000	-	-	-	-	-
	Grant	6,981	1,570	1,521	253	1,075	759	416	323	3,003
	Total	17,830	1,570	1,521	1,253	1,075	759	416	323	3,003
(%)	Loan	91.6	-	-	8.4	-	-	-	-	-
	Grant	43.9	9.9	9.6	1.6	6.8	4.8	2.6	2.0	18.9
	Total	64.2	5.7	5.5	4.5	3.9	2.7	1.5	1.2	10.8

Source: 34th Committee for International Development Cooperation (CIDC) (2020.1).

ODA Support in TVET Field in Korea

ODA Overview for TVET

In the field of TVET, ODA is a type of business that strengthens the capacity of individuals and society by enabling intangible and tangible social capital accumulation by acquiring knowledge and skills. In OECD/DAC, vocational training is divided into four areas such as basic education (primary education, early childhood education, etc), secondary education (secondary education, vocational education), higher education higher education, etc), and general education (teacher training, etc) is subdivided.

Recently, the concept difference between education and training has disappeared, and rather, the term of vocational education and training is used by integrating education and training. In particular, World Bank and ADB are integrating and promoting vocational education and training through TVET.

Currently, ODA projects in the field of TVET are providing policy advice to establish qualifications and other systems. In addition, the ODA of TVET project is mainly focused on project construction such as building an infrastructure for vocational training institutions, dispatching experts, and inviting trainees.

The Korean government has selected the CPS, a key area of ODA to support developing countries. In CPS, it was selected as a key field project in developing countries with many TVET and human resource development.

In the future, along with the progress of various international development cooperation projects in each field and the demand for support and cooperation in the TVET field has increased significantly in developing countries recently. Moreover, in the field of TVET, the

interest and local demand of developing countries are high, so it is necessary to prepare an efficiency and systemization plan that can respond to this.

In recent years, the type of business execution in the development cooperation field is changing from a project-oriented business to a program-type business, and from architecture and equipment-oriented hardware types to technology, experience, and know-how-oriented software types. In addition, the paradigm is shifting from development cooperation projects to strategic types such as sectoral and regional support.

Evaluation Results for TVET Projects

The prime minister office selected and evaluated 20 out of 150 projects completed in 2014-2017 in 2018. By field of project, size, region, type, and institution were considered, and were divided into basic education (2), secondary education (6), higher education (4), and vocational training (8). Table 8 describes the business targeted for vocational training.

The vocational training project is still the most carried out project, but there are many independent projects, which are limited in reflecting it in actual systems and policies. Considering the industrial structure of agricultural-oriented partner countries, there is a limit to actual performance in order for ODA business in TVET field to be linked to employment.

Table 8. Evaluation results of TVET Projects Under Korea's ODA

No	Project	Type of project	Budget (100 million won)	Period of project
1	Construction Project of Korea-Vietnam Vocational and Technical University in 5 Regions of Vietnam	project	389	2008~2016
2	Establishment of ICT Training Center in Bangladesh	project	433	2011-2015
3	Expansion Project of Nicaragua Vocational Training Center	project	149	2009-2012
4	Technology Training Center Project of Nepal Kathmandu University	project	40.35	2011-2014
5	Establishment Project of Pakistan Islamabad ICT Center	project	57.5	2010-2016
6	Manpower Training Project of Cambodia Software	project	6.0	2016-2018
7	Manpower Training Project of Cambodia Auto Maintenance	public-private partnership	2.5	2016-2018
8	Support Project of Rwanda Kichukiro Comprehensive Technical Training Center	project	56.5	2013-2017

Source: The Institute of International Development Cooperation. Comprehensive evaluation of education field in 2018. pp. 87-89

ODA Promotions of TVET Projects

KOICA and EDCF are promoting the TVET ODA project individually at the request of the recipient country. Vocational training-related organizations   have very little their own ODA budget. It is a form that participates in KOICA and EDCF projects depending on the situation without linkage and roles allocation between institutions.

PMC (Project Management Consulting)

PMC advises the establishment and remodeling of training institutions in the recipient country. PMC also provides training facility and equipment placement advice, and training to continuous capacity building.

Invitation Training

Invitation training projects include competency development of recipient country participant, target training by participant, training of managers and training teachers. The training projects are oriented to trainee participation and project-oriented training.

Expert Dispatch

The dispatch of experts will promote the following projects. Experts provide advice on facilities for each department (education environment conditions, equipment placement, etc), equipment lists and specifications for each department, and equipment inspection. It also advises on how to cultivate trainees and improve the employment rate, and how to improve customer satisfaction for students and businesses.

Curriculum Organization and Textbook Development

The following tasks are carried out in the curriculum organization and textbook development project. It includes the organization of curriculums for each department, the establishment of facility equipment standards, the development of training materials for each department, the development of instructional plans for each subject, and the development of instructional guidance and support for training materials(PPT, video etc).

Institutions Related to TVET

Table 9 describes specialty of the TVET and business areas of government agencies, private organizations, and national research institutes under the Government of Korea.

Table 9: Comparison of institutions, specialized fields and business fields in TVET

Classification	Institutions	Business Area
Affiliated with The Ministry of Employment and Labor	Human Resources Development Service of Korea (HRD Korea)	Vocational Competency Development, Vocational Competency Assessment, Supporting Foreign workforce Employment Helping Overseas Employment of Korean Youths, International Cooperation, Skilled Crafts Encouragement, National Competency Standards Development
	Korea University of Technology and Education (KUTE)	-4 year university. -Project Management Consulting, Project Contractor(KOICA), Invitational Training Program(KOICA), Consulting Service(EDCF), Feasibility Study(EDCF), Expert Dispatch
	Korea University of Technology and Education (KUTE)	-Project Management Consulting, Project Contractor(KOICA), Invitational Training Program(KOICA), Consulting Service(EDCF), Feasibility Study(EDCF), Expert Dispatch -Degree Programs: Industrial Associate's Degree Program (Two-year program), Intensive Major Course (Four-year course/night classes). -Non-degree: Vocational Training Programs, Vocational Training Program (State-sponsored), Master Technician Course, Unemployed Vocational Training, Improvement Trainings
	Korea Employment Information Service (KEIS)	In charge of collecting, analyzing, providing information related to employment, career, and job, supporting the advancement of employment services, and running the employment information system
Private	Korea Chamber of Commerce and Industry (KCCI).	Taking Actions on Current Economic Issues, Supporting Corporate Governance, Improving Regulation, Promoting of Corporate Social Activity, Educational Program, Management Counseling, Human Resource Development Project Management Consulting, Project Contractor(KOICA), Invitational Training Program(KOICA), Consulting Service(EDCF), Feasibility Study(EDCF), Expert Dispatch
	4 Year University and 2 Year College	Project Management Consulting, Project Contractor(KOICA), Invitational Training Program(KOICA), Consulting Service(EDCF), Feasibility Study(EDCF), Expert Dispatch
National Research Institute	Korea Research Institute for Vocational Education & Training(KRIVET)	-Conduct research on national policies for human resource development and support policy implementation, Support the network of stakeholders in technical and vocational education and training (TVET) and human resource development (HRD), Conduct research on TVET as part of lifelong learning for all and carry out related projects, Develop and propagate programs for TVET as part of lifelong learning, Conduct research on national and private qualification systems and support related projects, Evaluate TVET institutes and their programs upon request from the government, Provide information and career counseling for employment and career development, Establish and manage a system for collecting information and analyze the labor market trends on regular basis, Promote international exchange of information on TVET, Collect, organize, and disseminate information on TVET -Project Management Consulting, Project Contractor(KOICA), Invitational Training Program(KOICA), Feasibility Study(EDCF), Expert Dispatch

Classification	Institutions	Business Area
	Korean Educational	-To establish new education system reflective of traditions and realities of Korea, To conduct comprehensive and scientific research on current issues of Korean education, To develop an innovative educational system to address challenges of Korean education -Project Management Consulting, Project Contractor(KOICA) Invitational Training Program (KOICA), Feasibility Study(EDCF), Expert Dispatch
	Korea Development Institute(KDI)	-KSP(Knowledge-based Sustainable Growth Partnership) was initiated to share Korea's development experience and knowledge with the partner countries and design policy solutions. support sustainable socioeconomic development in partner countries and establishing cooperative networks

Recommendations

The ODA project is being decided and executed by the government. However, it is necessary to diversify programs for cooperation with civil society and expand development cooperation projects utilizing the technology of private companies. In addition, it is necessary to continuously expand the ODA size by discovering new projects and expanding the size of projects that actively reflect the demands of the recipient countries. For such policies to be established and implemented, long-term and systematic ODA policies must be established.

The proportion of ODA projects to developing countries in the TVET sector is increasing every year. The ODA business in TVET for developing countries is expected to continue to grow in the future. Korea's earliest ODA projects were centered on developing countries in Asia, but are gradually expanding to Africa and Latin America.

Strengthen the connection between the ODA project implementation institution and university

In the case of ODA's projects, the Ministry of Strategy and Finance is the main agency and the EXIM Bank is the executive agency. In the case of grant, on the other hand, the Foreign Ministry is in charge and the KOICA is the executive agency. In addition, about 30 government agencies and local governments other than the KOICA are also providing grant assistance.

Recently many universities carry out TVET ODA project for developing countries. It is difficult for universities to pursue ODA projects for developing countries by securing funds independently. With financial support from the KOICA and the EXIM Bank of Korea, it is necessary to plan a mid-to long-term support strategy in cooperation with the establishment of a system for strengthening research functions in the field of TVET. As a way to resolve these issues, KOICA, EXIM Bank of Korea and universities should sign a memorandum of understanding. It is possible to seek realization and positiveness of work through this action.

Universities have professors who combine theory and practice in various fields, including electricity, electronics, machinery and automobiles, IT, design, hotel management and restaurant businesses. Of course, infrastructure related to this is well-equipped. Most of these areas are required for recent projects in developing countries. Therefore, if universities strategically participate in ODA in terms of TVET, it will not only improve internationalization indicators, but also help attract international students and promote universities.

In order to achieve the purpose of this study, many domestic and foreign related data were analyzed. In addition, for in-depth analysis, ODA expert interviews and meetings were conducted. The recommendations derived through this are as follows.

Utilize national research institutes and universities

According to the results of many policy evaluation studies in TVET fields, ODA is focusing on building infrastructure for vocational education and training and supporting equipment and construction of building and labotary. However, it has been pointed out that ODA has weak S/W support, including the establishment and improvement of the system and human resources development. The role of the PMC should be played by national research institutes and universities to promote the effectiveness of the ODA project. In order to strengthen the ODA business in the TVET field, the focus is on providing software rather than hardware.

Establish and utilize global partnerships to enhance TVET capabilities

It is necessary to carry out various researches and projects in cooperation with international organizations in the field of TVET. To this end, various cooperative projects such as World Bank, ILO, ADB, CPSC and SEAMEO VOCTECH etc should be maintained and expanded.

Development of ODA professional TVET training programs

Recently, the form of business execution in the field of development cooperation has diversified. The paradigm is shifting from the project type to the program type and from hardware type to software type. In line with this trend, it is necessary to develop curriculums for fostering and retraining experts in the field of ODA in specialized research institutions and universities. To this end, the government should establish and utilize a cooperative system with officials in charge of the KOICA and the EXIM Bank of Korea and various entities, including the government, private organizations and universities.

Training and utilization of evaluation experts

Private participation in the stages of project implementation is expanding, but private experts' participation in project review and evaluation is low. It has been argued that professionalism and objectivity are insufficient. Self-assessment requires the participation of private experts, and it is necessary to continuously cultivate experts in evaluation.

Training and utilization of evaluation experts

For learners who cannot participate in TVET training in the classroom directly due to social problems or personal reasons caused by Corona 19 worldwide, training institutions need to provide online TVET training.

Establish and utilize TVET-related networks at the national

There are many political initiatives and associations in the network that work internationally to solve common challenges in the field of TVET, such as UNESCO-UNEVOC, NARRO, SEAMEO, RAVRTE, IVETA, CPSC and CINTERFOR. These international networks or organizations serve as catalysts for providing information about multinational projects in vocational education and training. In order to establish and utilize TVET-related networks at the national level, the following measures are proposed. We try to establish objective cooperative partnership agreement for the network to strengthen the impact of cooperation on improving TVET policies at the national level.

TVET Implementation via Online

For learners who cannot participate in TVET in the classroom directly due to social problems or personal reasons caused by Corona 19 worldwide, training institutions need to provide online TVET. On-line TVET should provides comprehensive education and training services tailored to learners so that learning information can be easily used by anyone, anytime, anywhere.

Online education and training should contribute to the activation of education by utilizing various online delivery systems such as portal, mobile, and SNS.

Conclusions

Korea is recognized as an excellent case of a successful transition from a recipient country to a major donor country in a short period of time. In particular, Korea has a comparative advantage over other DAC donor countries because it has developed knowledge and development experience based on the actual experience of the recipient country among developing countries.

Korea shares its ODA experience in TVET development with developing countries and serves as a bridge between developing and developed countries. Korea has already established a number of TVET institutions in developing countries and is steadily promoting various policy advice.

In the TVET field, there is a growing demand for international development cooperation from developing countries, but various projects other than the invited training program have not been properly implemented. In developing countries, it is difficult to analyze the demand for technical manpower in the labor market, lack of systems involved in the TVET system and operation, and insufficient response to the demands of TVET programs.

Developing countries have a relatively high proportion of younger age groups, so they have high growth potential and high geopolitical value as a new base region connecting the East and the West. Korea is in a position to serve as a bridge between developed and developing countries, and is a key country that supports economic and social development in developing countries.

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A Study to Identify Ways of Enhancing Industry Partnership Towards Technical Education- The Sri Lankan Context

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Abstract

Adequate partnership between DTET institutions and industries would lead to provision of relevant practical skills for industrialization.The purpose of this research paper was to examine the industry partnership between Colleges of Technology and Technical Colleges of Department of Technical Education & Training and the industry and enhancing the ways to develop strong partnership between technical institutes and industry. The article recommends that the industry should provide contemporary skills by training and establish networks with DTET institutions for minimizing the gaps. The authors of the article consider that collaboration, the important means can be made the highway to bridge the gap and to enhance employability skills of DTET in Sri Lanka.

Keywords: Department of Technical Education and Training (DTET), Partnerhip, interaction, enhance

Background

Sri Lanka is the South Asian multi- national and multi-religious country in which 21.4 million people living in urban and rural areas and male population is 49.3% and female is 50.75%. The total area of the country is 65,610 km2

In the country, vocational training and education plays a vital role among the youths who fail to do Ordinary Level and Advance Level in ordinary system of education and fail to enter the national Universities of the Country.Vocational training is currently provided by mainly the government and private vocational institutes. It is important to mention that these all vocational institutes are under the Tertiary Vocational Education Commission (TVET). Department of Technical Education and Training under which there are 09 colleges of Technology in 09 provinces of Sri Lanka. In addition, there are 30 technical colleges under the purview of the DTET.

Research Problem

The relationship of DTET institutes with industries is of paramount importance since the primary business of these institutions to interpret the market demand signals and prepare human resources to satisfy the manpower needs of industry. Sustainable relationships between the Colleges of Technology and Technical Colleges under the purview of Department of Technical Education and Training and industries are established for reasons which benefit both entities. Linkage between DTET colleges and Industry refers to activities which are mutually beneficial to both parties involved in the relationship.

Technical and Vocational Education and Training (TVET) is one of the most powerful instruments for economic, social and political developments. It is a means for enabling all members of the community to wisely use modern technology and help to solve their problems but the relationship DTET institutes, industry and community has traditionally not been a close one. It has also a great impact in producing skilled manpower that has substantial role in the development of the country. Hence, many countries have recognized the importance of TVET and have been taking different measures since the last three decades to maximize its effectiveness in their education system (UNESCO, 1999).

Another vital issue is the most of the instructors are lack new technology. Therefore, they need to upgrade their new technology. Furthermore, DTET is lacking Memorandum of Understandings (MOUs) between DTET institutes and industries. Speaking of economic transformation particularly in the global competition, each country – with respect to the purpose of achieving economy-based knowledge is required to develop the knowledge of workers who are competent, adaptive, and innovative. TVET has proven to play an essential role in promoting economic growth and socio-economic development. World Bank had argued at the time that the cost of technical and vocational education was too high compared with the returns to the economy, that the quality of training was poor and that there was considerable mismatch between training and the needs of industry. In short, the delivery of vocational education and training was not cost effective.

The vision for Technical and Vocational Education and Training (TVET) of Department of Technical Education and Training (DTET) in Sri Lanka is to create and help to solve their problems but the relationship DTET institutes, industry and community has traditionally not been a close one. It has also a great impact in producing skilled manpower that has substantial role in the development of the country. Hence, many countries recognized the importance of TVET and have been taking different measures since the last three decades to maximize its effectiveness in their education system (UNESCO, 1999).

Research Questions:

1. To what extent DTET institutes have taken necessary actions to interact with industry?

2. To what extent industry follow the DTET training procedures?

3. To what extent DTET instructors are upgraded through partnership?

4. To what extent industry involve to prepare proper training package

Significance of the Research

The research findings will be significant at the different levels of the Department of Technical Education and Colleges of Technology and Technical colleges scattered through the country.

Research findings will support all top middle and lower level managers to understand the prevailing situation of the industry linkage between DTET and the industry. Further, research findings would assist to enhance strong linkage between DTET and industry.

Research Framework and Literature Review

The study defines partnership as "a relationship resembling a legal partnership and usually involving close cooperation between parties having specified and joint rights andresponsibilities" (Merriam-Webster dictionary). Figure 1 on the left shows that enhancing technical education depends on the industrial partnership of DTET which involves key activities as indicated.
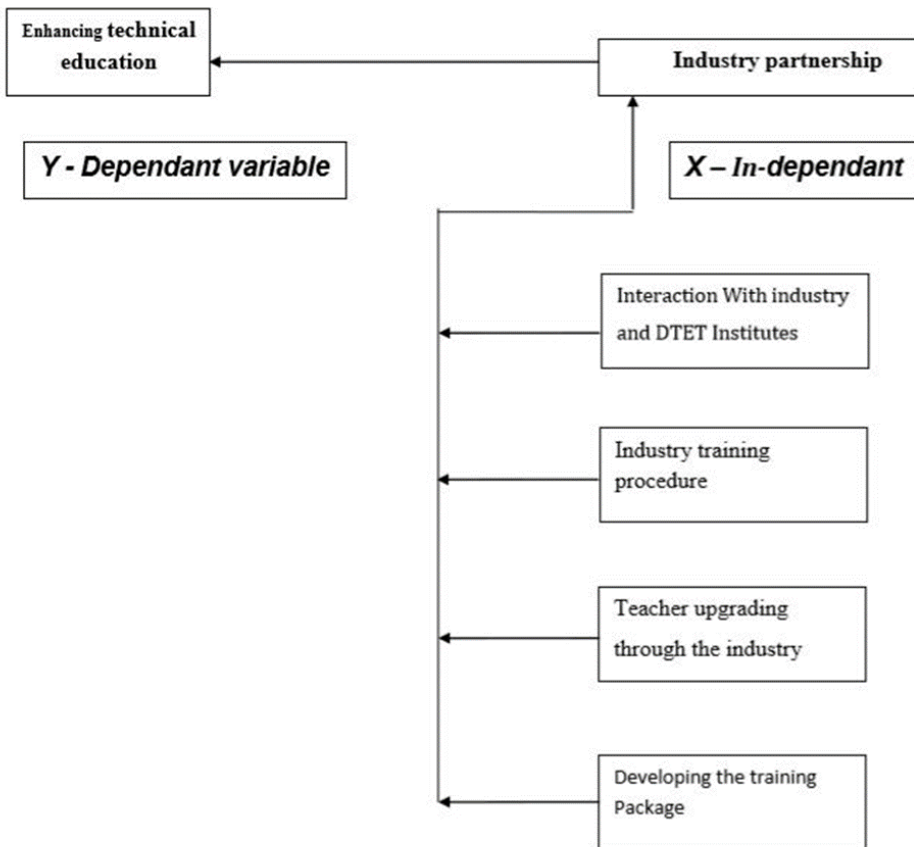

Figure 1: Conceptual Framework of the Study

Figure 2: Definition of Partnership in the study wihich is a combination of cooperation and joint rights and responsibility

Partnership with the industries and the technical and vocational institutions are the major rising concern in many developing countries like Sri Lanka. International recommendations of UNESCO for the improvement of technical education and vocational training systems systematically referred to the need to forge closer links between training and the labor market.

It was considered by UNESCO that industrial attachment was the most pronounced linkage; lack of initiative by TVET institutions and poor response from the industries were among the major challenges facing the collaboration of TVET and industry. The interaction between research institutions and the industry has been considered a strategic instrument for national and regional innovation, competitiveness, and economic growth (Rast et al, 2012).

TVET institutions operate in an environment characterized by fast technological progress, emerging careers, changing jobs requirements and increased competition. These changes have necessitated an industry-institute collaboration in order to address this challenge (Plewa& Quester, 2008). Companies that collaborate with learning institutions typically have higher productivity rates than companies that do not have such collaboration (Cedefop, 2016; Malairaja&Zawdie, 2008).

The Third international congress on technical and vocational education and training on "transforming TVET: Building skills for work and life" in Shanghai, China recommended that TVET delivery must involve a broader partnership with multiple stakeholders.In observing the competencies of TVET graduates there are numerous criticisms of technical education and vocational training have been voiced over the past decade (World Bank, 1991; Moura Castro, 1999). They may be summarized as: (1) poor quality; (2) very high cost; (3) unsuitability of training to actual socio-economic conditions; (4) disregard of the informal sector's needs; and (5) disregard of the labour market and of the high unemployment rate among graduates.

Importance of Industry- TVET Institution Partnership

It is important to mention that the high rate of unemployment and other economic hardship in developing countries. Sri Lanka has become of great concern. Although various government interventions have been in place in Sri Lanka to alleviate the problem of unemployment and poverty among the citizens, many graduates of different educational levels especially the tertiary level stay at home several years after graduation without a living job.

This scenario cuts across all disciplines including Technical Vocational Education and Training (TVET). TVET graduates who are supposed to be equipped in knowledge, skill and

attitudes for the world of work are not even left out in this evil of unemployment. In addition, another principal reason is that the skills of Sri Lankan TVET graduates mismatch the industry requirements. This is achievable through workplace-based/practical training. The workplace-based training is more possible through an enduring partnership between TVET institutions and industry. TVET institutions and organizations, should therefore, promote the employability of graduates through work integrated learning approaches based on TVET institutions—industry partnership. Through the strong partnership, the TVET institutes and curriculum developers and policy makers are able to understand the industry requirements and their expectations.

Furthermore, TVET graduates should have employability skills. Employability implies the work readiness of graduates. Employability skills include communication, interpersonal, teamwork, problem solving, research and analytical, planning and organizing, technology and life-long learning skills. They are the generic skills every worker is expected to possess to work smoothly and comfortably with management and colleagues in organizations. Employers tend to value employability skills more highly than disciplinary-based understanding and skills (Yorke, 2006; Harvey, 2005). Employability skills are major recruitment concern of employers in both developing and developed nations of the world. The concern over lack of work readiness displayed by business graduates in particular has generated academic as well as industry-based research (Central Queens and University, 2009; Tindale, Evans, Cable, & Mead, 2005) into how tertiary accounting curricula can improve in relation to developing accounting graduate's employability and professional work skills. Published research in other growth regions of the world also indicate mismatch between graduate skills and employers' expectations. This is particularly in relation to problem solving, communication, teamwork, and management skills. Some of such researches include examples from New Zealand (Hodges &Burdel, 2003); Sri Lanka (Wickramasingle&Perera, 2010); South Africa (Pop & Barkhuizen, 2010); Japan (Sugahara&Coman, 2010), China (Rose, 2013) and Malaysia (Chang, 2004; Davd, Abidin, Sapuan, &Rajadura, 2011). The implication, therefore, is that there should be urgent and greater collaboration, partnership and feedback between industry and educational institutions, particularly TVET institutions, to develop training systems that are more relevant to industry.

According to the UNESCO-UNEVOC online conference 2012 report on "strengthening TVET teacher education", it empathizes as follows

- Industry as an essential component in ensuring the effectiveness of TVET institutions in generating qualified and skilled workers

- The strengthening of linkages between TVET teachers and industries is considered as crucial in preparing students to meet the dynamic work requirements

- TVET institutes depend upon industry as a means of accessing the latest technology and practices

- Industry acts as a benchmark to establishing the level and types of TVET skills currently required

- Close collaboration between TVET teacher education and industry would significantly improve the quality and relevance of TVET and strong industry-TVET relationship ensures better students' employability

Causes of Skills Gap between Industry and TVET Institutions

It is important to mention that there are skill gaps in Sri Lanka between industry and TVET institutions which is common to other TVET institutions in the world. The teaching methods in TVET institutions in Sri Lanka have not succeeded in impacting positively on practical skills acquisition of graduates of TVE institutions. These methods of instruction include: the traditional lecture method based on sound theoretical background, group discussions, field trips and Students Industrial Work Experience Scheme (SIWES).However, modifications of these approaches are very imperative to meet the current industry challenges Oduola (Olorufemi&Ashaolu, 2008).

The Organization for Economic Cooperation and Development (OECD) used a diagnostic analysis in Philippines and mapped the skills equilibriums by region and analyzed the biggest challenges and gaps of the TVET system, which is heavily supply-driven, has little responsiveness or flexibility to the demands of the labour market, and has a poor reputation amongst stakeholders. TVET provision is also underfunded compared to general academic pathways, which can contribute to variable and low-quality training.

SKILLS GAPS AND SHORTAGES	HIGH SKILL EQUILIBRIUM
LOW SKILL EQUILIBRIUM	SKILLS SURPLUS

Skills Supply
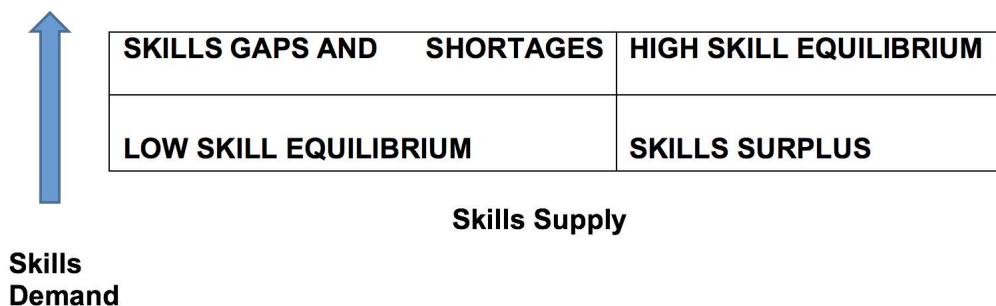
**Skills
Demand**

Figure 3: Skills Gap. Source: Bridging the Gap: The Private Sector's Role in skills Development and Employment, Summary Report (2016)

The Challenges of Partnership

In dealing with the technical education in Sri Lanka, it is believed that technical education and training should be focused on enhancing labour productivity. Therefore, a developed TVET system is considered as a necessary condition for successful economic development. The industry lacks interest. (shown in figure 4) in investing money in linkages with TVET.
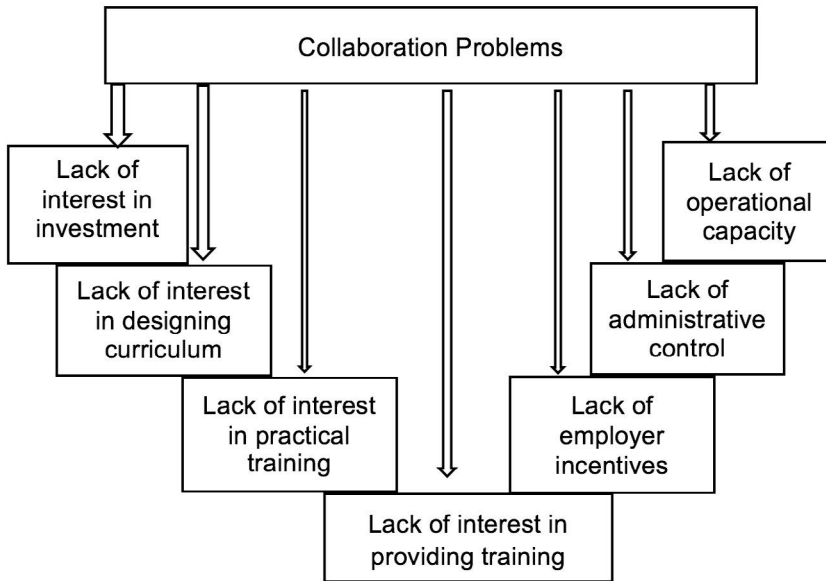
Figure 4: Collaboration Problems. Source: Raihan (n.d.).

Methodology

Research Formulation

A descriptive survey method which employed both qualitative and quantitative approaches is employed to undertake this research. Eighteen (18) recognized (registered under ICTAD) industries are selected by random sampling techniques from nine provincesleaving the structural questionnaire aside, quantitative data are gathered from 40 students out of different fields and industry partnership was chosen as the conceptual body of the research in which empirical survey to be done. Enhancing technical education was the theoretical phenomena by which large volume of theoretical background has been framed. Present research was formulated to explore the significance of industry partnership of industry people and DTET passed out students. Accordingly, the study would identify the findings. The findings would be forwarded to enhance the ways to build up strong partnership between DTET colleges and industry.

Method of Data collection

Two questionnaires as research instruments were used to gather data as it is the best and powerful tool for acquiring data. In order to administer the two types of questionnaires in connection with present study, two population were chosen as follows.

1. DTET passed out students were selected as one group to administer a questionnaire.

2. Another questionnaire was administered to industry people.

Method of Data Analysis

The questionnaires were developed on five-point Likert scale and converted the response into 5point scaled values. The scale is depicted below.

+2	High positive effect (factors is highly influential to change Y variable)	
+1	Moderately positive effect (factor is influential to some extent to change the Y variable.)	
0	Null effect (In deferent cannot judge whether influential or not.)	
-1	Negative effect (Factor is not influential, thus cannot judge Y).	
-2	High negative effect (Factor is not influential at all never possible to change).	

Figure 5: Scale of Response Interpretation

The mean from the responses in the Likert Scale, as well as Standard Deviation, were used to measure the level of influence and the level of significance respectively. The arithmetic mean (x) of the view of respondents was used as the "score" for each indicator and standard deviation (SD) of each score was used to check the variability of factors (indicators) that had been affected in each situation.

The variable effect (whether the given variable significant or not) was assessed in terms of statistical criteria as shown in the methodology chapter. Accordingly, smaller the standard deviation value was considered as larger the effect of views of which statistically known as "significant". As same as, larger standard deviation value was considered the factor was "insignificant".

If the mean is 0, It means that there is no influence. If the mean value is closer to 1, if indicates that factor is influenced up to a certain level. If it is closer to 2, it indicates that the factor is highly influential. However, the standard derivation value determines whether the existing influence is significant or not.

Results And Discussions

Table 1 discusses the mean values of the effects of the level of interaction with industry and TVET institutes.

Table 1: Effect on level of Interaction with industry and DTET Institutes: Views of Industry People.

Indicator	Mean value
1. Appropriate agreements are signed by employers and DTET institutions.	1.8
2. Informed of college requirement and expectations.	-1.0
3. Effective communication exists between DTET institutions and employers/industries during the training programme.	0.7
4. Attitudes of the students is positive.	0.5
5. Discipline and behavior of the students are in a satisfactory level.	-0.65
6. Arrival and departure of students on time.	0.6

Table 1 shows that effectiveness on the appropriate agreements are signed by employers and DTET institutions was 1.8 which indicates that variable influenced largely to increase the interaction. Another indicator on effect on the informed of college requirement and expectations takes -1.0 mean value, which indicates that variable influenced to decrease industry partnership up to some extent.

The indicator on effect on the effective communication exists between DTET institutions and employers/industries during the training programme takes 0.7 mean value and it indicates that variable influenced to increase the effective communication between DTET institutes and industries up to some extent. The mean value on effect on the attitudes of the students is positive was 0.5 which indicates that variable influenced to increase positive attitudes of the students up to some extent.

The effect on the discipline and behavior of the students are in a satisfactory level -0.6 which indicates that variable influenced to decrease the satisfactory level on discipline and behavior of the students up to some extent. The last indicator on effect on the arrival and departure of students on time takes 0.6 mean value which indicates that variable influenced to increase the arrival and departure on time up to some extent.

Table 2: Effect on the Industry training Procedure: Views of Industry people

Indicator	Mean value
1. Adequate support services, and facilities are provided for students by employers.	0.8
2. On any study, research with the training institute to upgrade the students.	-2.2

Table 2 shows that the mean values were 0,8 and -2.2 respectively. The first indicator influenced to increase industry partnership up to some extent. The second variable influenced largely to decrease industry partnership.

Table 3: Effect on the Teacher upgrading through the industry: Views of Industry people.

Indicator	Mean value
1. Availability of teacher upgrading programme at your organization.	0.95
2. Availability HR division to upgrade the new technology of the DTET Instructors.	-0.80
3. Soft skills of the students is in a satisfactory level.	-0.80
4. Knowledge and skills of the students to match your requirements.	1.1

According to the table 3, effect on the availability of teacher upgrading programme at the organization has a 0.95 mean value, which indicates that Variable influenced to increase the partnership between the DTET institutes and industries up to some extent. The effect on the availability of the HR division to upgrade the new technology of the DTET instructors and effect on soft skills of the students is in a satisfactory level, with a -0.8 respectively and the variable influenced to decrease the industry partnership up to some extent.The mean value on effect on Knowledge and skills of the students to match the requirements was 1.1 which indicates that variable influenced to increase the industry partnership up to some extent.

Table 4: Effect on the developing the training package: Views of Industry people.

Indicator	Mean value
1. Effects on the students' progress and wellbeing are regularly monitored by the college and work place –based supervisors.	0.05
2. Effect on the availability of strong partnership with your institute and carrier guidance officers regarding job placement and training.	1
3. Effect on employers are given guidelines on how to evaluate students.	-0.75
4. Effect on the objectives of the training programme is made available to students.	-1.05
5. Effect on availability of training facilities for the students at your unstitutioon	1.1
6. Effect on donated training materials to DTET institutes.	1.1
7. Effect on instructors upgrades to the the new knowledge	-0.5

Table 4 it shows that the mean value of effects on the students' progress and wellbeing are regularly monitored by the college and work place –based supervisors was 0.05. This shows that the variable influence in increasing the industry partnership very small.

Table 5: Effect on level of Interaction with industry and DTET Institutes: views of Trainees.

Indicator	Mean value
1. Effects on the level of interpersonal relationship with others in the work place.	1
2. Effect on the all modules content was relevant to my job at the workplace.	0.16
3. Effect on the feel there is a lack of assistance from my instructor.	1.33
4. Effect on during the training period, there is a linkage between training institute and the training place.	0.83

Table 5 indicates that the mean value of effects on the level of interpersonal relationship with others in the work place was 1. It shows that the variable influenced to increase the partnership with DTET institutes and industries up to some extent.

The mean value on effects on the level of interpersonal relationship with others in the work place was 1 that demonstrate that partnership with DTET institutes and industries up to some extent. The mean value of effect on the all modules content was relevant to my job at the workplace was 0.16 which indicates that variable influenced to increase the partnership with DTET institutes and industries up to some extent.

The indicator on effect on the feel there is a lack of assistance from my instructor took 1.33 mean value which indicates variable influenced to increase the partnership with DTET institutes and industries up to some extent. The mean value on effect on during the training period, there is a linkage between training institute and the training place was 0.83 which means variable influenced to increase the partnership with DTET institutes and industries up to some extent. The mean value on effect on during the training period, there is a linkage between training institute and the training place was 0.83 which indicates variable influenced to increase the partnership with DTET institutes and industries up to some extent and the mean of mean was 0.864.

Table 6: Effect on Industry training procedure: Views of Trainees.

Indicator	Mean value
1. Good working environment at my training place.	1.17
2. During the training period, I received upgraded technology.	0.83
3. Regularly monitored by the institute.	0.83
4. Training resources and equipment were in good condition.	0
5. Present at workplace every chance to practice what learned in the modules.	0
6. RTO calls regularly to see how I am going.	1
7. RTO should spend more time with me during visits.	1
8. Tools and resources were provided to do my job well.	1.17
9. The company provides solution for my problems related to training.	0.33

According to the table 6, it indicates that mean value on effects on the good working environment at my training placewas 1.17 which indicates that variable influenced to increase the performance up to some extent. The mean value on effect of receiving upgraded technology was 0.83 which indicates that variable influenced to increase the performance up to some extent.

Summary of Research Findings

Table 7: Summary of the Industry-Institution Linkages

Core variable	Mean of mean value
Interaction with industry and DTET institutions	0.59
Industry training procedure	0.70 (maximum mean value)
Teacher upgrading through the industry	0.1125
Developing the training packages.	0.136

Table 7 summarizes the mean values of the effects of industry-institution linkages to the positive of negative effects of industry-institution interaction.

Based on the values, it is nseen that among the four core variables, teacher upgrading through the industry and developing the training packages have found largely influenced to enhance technical education.

Recommendations

The recommendations given depend on response given by directors' principals and industry people about their partnership with industries. It also depend on response given by students about the partnership with industries. It is important to mention that the variables had low mean values. Therefore. They must be improved to enhance industry partnership towards technical education.

- DTET institutes should give token reward to firms that host student on attachment. This was seen as a way of encouraging industry to continue absorbing most of students for attachment.

- Industrial visits by DTET directors, principals and heads of DTET should be enhanced as a way of increasing industry-institute partnership and give managers firsthand experience on the happenings in the industry.

- Joint research between training institutions and the industry on specific projects or assignments should be enhanced. This form of interaction increases the solid bond between institutions and the industry which is healthy for academic and economic achievement.

- DTET graduates would be a very good resource for DTET institutes and they wish to intensify their interaction with industries. It is therefore, suggested that all the DTET institutes should have very active alumina associations.

- It is suggested that academic representative from each DTET institutes should be nominated to work with industries

- Once or twice a year, each DTET institution should hold Public Open Days and job fairs and industry forum. The purpose of these events would be to build community awareness about the educational opportunities on offer at that institution and to boost enrolments.

- Memorandum of Understanding/Agreements (MOUs/MOAs) are helpful to enhance partnership. Therefore, MOUs and MOAs can be signed between the DTET institutions and industries for mutual benefit.

- The industry training procedure should be prepared by collaboration with DTET institutes and industries because mutual understanding is benefit for both to enhance solid linkage

- Industry partnership is positively affected to enhance update knowledge and skills of instructors. Research findings demonstrated that it must be improved. Accordingly, the instructor visits to industry are also vitally important to gain update knowledge and skills and help them to develop networks with employers and use their contacts to help them.

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English, A Need? A Closer Examination of Vocational Undergraduates' Perceptions on the Need for English Language Skills in the Academic Life

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Abstract

In order to cater to these changing needs, two branches of English Language for Teaching (ELT) namely English for General Purposes (EGP) and English for Specific Purposes (ESP) have emerged. Although EGP is what is observed to be practiced in the ELT classrooms over the years ESP has created an immense interest among ELT practitioners desiring to make a change in academic and professional setting. The aim of the research is to find out what type of content is required to fulfill the aims of the students academically. The current study which blends both qualitative and quantitative methods was carried out with 40 undergraduates Findings of this needs analysis revealed that EGP alone would not cater to the needs of the stakeholders as the students were expected to reach out to the industry after completion of the degree and in this sense suggestions were brought forward to design a curriculum with a blend of ESP and EGP. There was a strong recommendation of revising the current curriculum to suit the requirements of both the academic context and the context of the target career.

Keywords: English for Specific Purposes (ESP), English for General Purposes (EGP), Needs Analysis (NA), language skills, stakeholders

Introduction

The demand for vocational education seems to be on the rise with the need to employ graduates who are not only paper qualified but also skilled. Vocational Education which was not talked about for many years in Sri Lanka came into light in 1971 with the increase of the unemployment problem. The evolution of The National Vocational Qualification framework, or NVQ, as famously known, has paved the path for youth of Sri Lanka in providing the opportunity to achieve international recognition for qualifications, skills and knowledge.

NVQ framework consists of seven levels of qualifications from Level 1 to Level 7. The first level which is the National Certificate is recognized as the acquisition of a core of entry level skills. Level 1 is followed by National Certificate for Level 2, 3 and 4 which are recognized as increasing the levels of competencies. Further Level 4 qualification is awarded for full national craftsmanship. Level 5 and 6 is the National Diploma, awarded for the recognition

in the increasing levels of competencies ranging from technical level to management level. The final on which the current study is based on is NVQ Level 7 which is the Bachelor of Technology degree and this is awarded by the only vocational degree awarding body in Sri Lanka which is University of Vocational Technology (UNIVOTEC) which is also the setting for the current study. .

Univotec was established in the year 2009 with the objective of opening the path to students from the Technical Education and Vocational Training System, entering into the university based on their aptitudes and abilities, to acquire university education. Unlike the conventional university education system in which the education is more focused on learning, Univotec produces graduates with a degree that is furnished with specific knowledge and skills needed to perform a particular job role. As the entrants to Univotec have diverted from the traditional education system there are many who have only qualified themselves up to Grade 8 or followed up to the GCE Ordinary Level exam but had not completed the exam, and a minority who have sat for GCE Advanced Level examination but had not gained entry to a state university. Although it could be to a certain degree considered advantageous, it could be considered disadvantageous especially with regard to English language proficiency the respective undergraduates are at a very low level. This has however hindered the education of many undergraduates which has recorded a large dropout rate especially as the medium of instruction is English. Therefore this observation made the researchers to commence the current study with the Bachelor of Technology (B.Tech) in Mechatronics degree undergraduates as it draws a large amount of applicants each year comparatively to other degree programs and has also resulted in a very high dropout rate.

Hence the current study explored the answers to the following research question: What are undergraduate's academic communicative expectations?

"Communication Skills", should it be EGP or ESP?

Currently, Univotec offers an English module titled "Communication Skills" which is offered to the undergraduates in order to support the degree programs as they are offered in English yet this has not given a productive outcome. As per my observations as a lecturer of the respective module the "Communication Skills" module consists English for General Purposes (EGP) and less of English for Specific Purposes (ESP).

Thus this study was carried out to explore the views of the undergraduates of Univotec in order to find if they were comfortable with the current EGP module or needed a more ESP module that would be more beneficial for the performance both at the academic and the industry level.

As per Hutchinson and Waters (1989) English Language Teaching (ELT) could be broadly divided into two branches and one is English for Specific Purposes (ESP) while the other being English for General Purposes (EGP). While EGP is more focused on developing a strong language foundation of the learners in consideration of basic grammar and communication, the focus of ESP is primarily   on the language and instruction that is more focused on specific communicative needs that engages in development of communicative competence in a specific discipline such as accounting, Information Technology etc.

With the knowledge gained from ESP, it would be beneficial for students in application of what they have acquired to their major field of study, that would include subject areas such as accounting, business management, economics, or Information Technology.

Islam (2014) in his study brings out the differences and similarities in the roles of ESP and EGP and he states that the key focus of EGP is on general English language abilities of students whereas the focus of ESP is on specific skills and needs of learners based on a detailed analysis of learners' professional/academic needs. Rahman (2015) too brings a similar statement highlighting that the learners and their purposes for learning English as the important difference between ESP and GE (General English) and ESP learners are highlighted as adults who already have some acquaintance with English and learn the language so as to communicate a set of professional skills and to perform particular profession-related activities. While comparisons on EGP and ESP are drawn hence Larouz and Kerouad (2016) highlights that as per many scholars and researchers the methodology in ESP bears a lot of similarities with methodology in EGP. Although ESP is said to prepare the students for authentic situations, both EGP and ESP incorporate the same concepts and approaches such as authenticity. As per Zohrabi (2013), EGP is highlighted as a foundation course in any curriculum which paves the way for ESP.

Mackay and Mountford (1978) states that the term "languages for special purposes have been a key interest in relation to English Language Teaching (ELT)". The purpose of "languages for special purposes" is defined with reference to occupational requirement and this definition applies to ESP as well. The aim of ESP is to develop learners' communicative needs especially for improvement. ESP students generally possess fundamental language skills and this is done in preparation for their career path. Thus for this particular reason ESP concentrates lessons on grammar and language but focuses more on language in context. ESP which is developed as an independent discipline has gained much popularity throughout the world. It is largely acquainted with tertiary education as students specialize in different areas. One such example that could be brought out is if an individual is to work as a receptionist, thus the terminology and the language skills that they would be expected to use will enable them to confidently respond to the concerns of their customers. Thus in their learning of the language the expectation will be not to learn complex grammar but merely the language that is required to perform their job effectively.

Further ESP emphasized as a solution to learners which was not fulfilled by General English to meet the needs of learners in order to be used in their professions. ESP is an independent discipline from EGP and it has gained acceptance throughout the world. ESP hence is more concerned with the career path of the learners and it plays a vital role in the development of communicative needs of the learner.

These definitions of ESP are provided in order for the researcher to get a broader understanding of the two terms EGP and ESP and the context that they are used in and give the reader a view of what will be looked at in the current research.

Research Methodology

While the choice of the setting was Univotec and the degree being B.Tech in Mechatronics and the study was carried through a Needs Analysis (NA). The reason for the incorporation of the NA is that the long term goal of the current research is to develop a curriculum for the respective target group. According to Ting (2010) NA is the first stage in ESP curriculum design before syllabus, materials and teaching activities are decided.

As quoted by Veena (2016), Richards (2002) the first step in conducting a needs analysis is to decide exactly the purpose or purposes for carrying out a NA and following steps have been listed as major purposes of needs analysis.

1. To find out the skills a graduate needs in order to perform a particular role at a workplace.

2. To examine if the existing curriculum adequately addresses the needs of potential students.

3. To know the needs of a particular category of learners in order to train them in specific skills.

4. To discover the gap between needs and abilities

5. To collect information about the language related particular problem the learners are experiencing.

6. To gather information of the learners pursuing a learning program; their attitude to learning the English language; their previous learning experiences; cultural background should also form a part of this information gathering process.

7. To assess the effectiveness of the prevailing program and to gather information regarding the preferred styles of learning or learning needs, importance of particular language skills for the learners, role relationship between teacher and learners, preferences of teaching learning activities etc.

Brown (2009) defines NA as a systematic collection and analysis of all information that is necessary for defining a defensible curriculum. In the current study, the NA model introduced by Brown (2009) had been incorporated and that is because Brown's NA approach is seen as the most relevant to conduct the current study and its step by step guidance made it easy for me in carrying out the NA which otherwise would have been a trying task .

Thus the NA applied is carried out with three systematic steps: (1) making basic decisions about the needs analysis, (2) gathering information, and (3) using the information. These steps consist of 10 steps as follows:
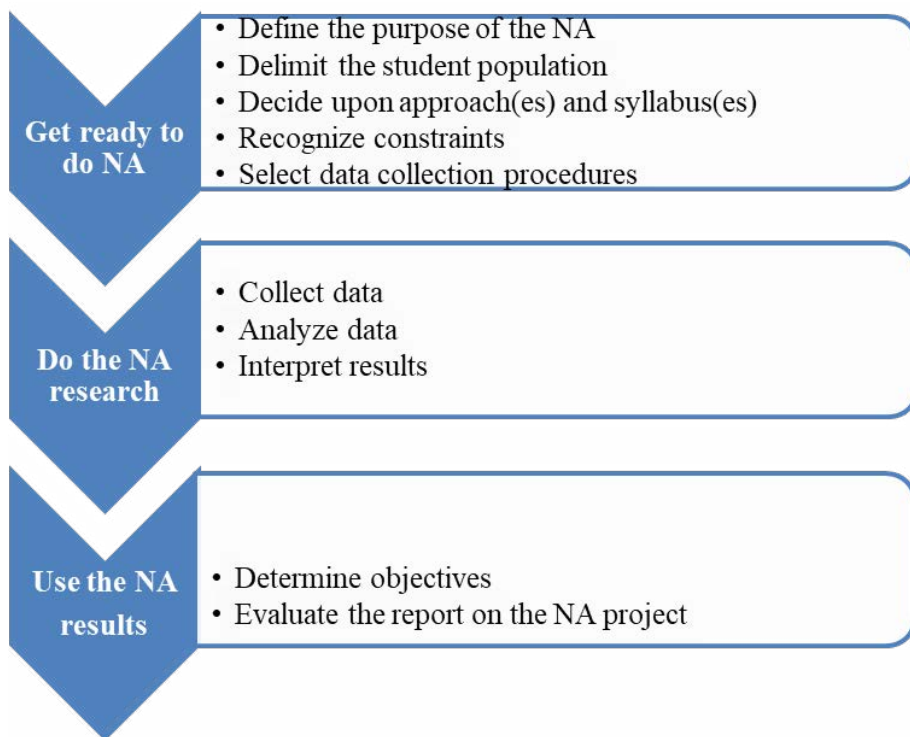
Figure 1: Needs Analysis process (adopted and adapted from Brown, 2009)

While the center of the current research is a Needs Analysis (NA), the researchers have incorporated qualitative and quantitative research design. As per Richards (2005) 'qualitative and quantitative data do not inhabit different worlds. They are different ways of recording observations of the same world' (p. 36). Inspired by Richards (2005) a mixed methods research design is adopted in the study while data collection tools such as questionnaires have been incorporated interviews were used to obtain qualitative data.

The Study Sample

As the main concern of my study is exploring the English Language needs of students to enhance their academic and professional performance the sample size is limited to undergraduates following B.Tech in Mechatronics. In order to choose the study sample, the Purposive Sampling technique was used and as Palys (2008) highlights , purposive sampling is seen as a series of strategic choices about with whom, where and how a researcher carries out a research.

As a long term goal of the study the researchers intend to propose a curriculum outline for the B.Tech in Mechatronics program, the undergraduates were selected from the respective degree program and the sample consisted of both male and female participants and they were Sinhala and Tamil first language (L1) speakers.

Analysis of Data

The obtained data from the interviews were transformed from the recordings into texts. Furthermore the interviews that were conducted in Sinhala were transcribed and translated into English while interviews conducted in English were directly transcribed.

The data which was pre-coded and coded was put under themes to carry out comparison effectively. While qualitative data was analyzed hence the obtained quantitative data from the questionnaire were descriptively analyzed. The quantitative data was used for more or less triangulation of data that was obtained from the qualitative data methods. As the strength of data was more focused on qualitative data analysis, the quantitative data was not analyzed in depth.

Results and Discussion of Findings

The data that was obtained from the Needs Analysis was analyzed in the respective segment under two major themes namely English Language Needs in Academic Life and English in the Work Environment.

English Language Needs in Academic Life

Majority of the undergraduates expressed the need for "English" in order to perform in both theory and practice based sessions in the academic context as English is the medium of instruction at Univotec. Apart from the fact that English was a need in academic performance certain statements highlighted that as the majority of the text books in relation to Mechatronics is in English in order to read and understand the books, journals and handouts provided by the lecturers English is essential.

Mechatronics consisted of a larger composition of Technical Terms and for this reason to understand the terms better English was vital and by knowing the meanings of the technical terms one was able to perform better at examinations. Although the academic requirement was more on the Technical Terms at present although they were taught "Communication Skills" yet these lessons did not cater to the need of learning Technical Terms and the lessons and the handouts were criticized as they were more on General English than on their subject related "English"

However it was pointed out that the module consisted of more of General Vocabulary and this as per the views of the students was only helpful in writing essays. Writing essays was given priority over Mechatronics terminology by the language lecturers as per the views of the undergraduate and also the curriculum consisted of the respective area for development and paid no attention to the technical terms building .

Many expressed that there is a strong need for English when it comes to Examinations. As per the undergraduates at the exams it was necessary to know how to write and read well in English.

In the exploration of the attitudes of the students towards writing and reading   as used in the examinations, it was reflected that the majority of the students were observed to have scored well in practical components while many have failed to do so at written exams. Their frustration in their inability to articulate their ideas and knowledge in English are expressed as follows:

As per the undergraduate view which is the prime concern in the following study around 40% stated it to be Very Important while a 50% settled into say that it is quite important. Thus a majority of the undergraduates have expressed writing to be of utmost use especially at the examinations. It was emphasized that at the exam the writing skill was essentially required. The undergraduates stated that writing was occasionally practiced at the classroom level and less concentration was given on how to write accurately for questions at the exams.
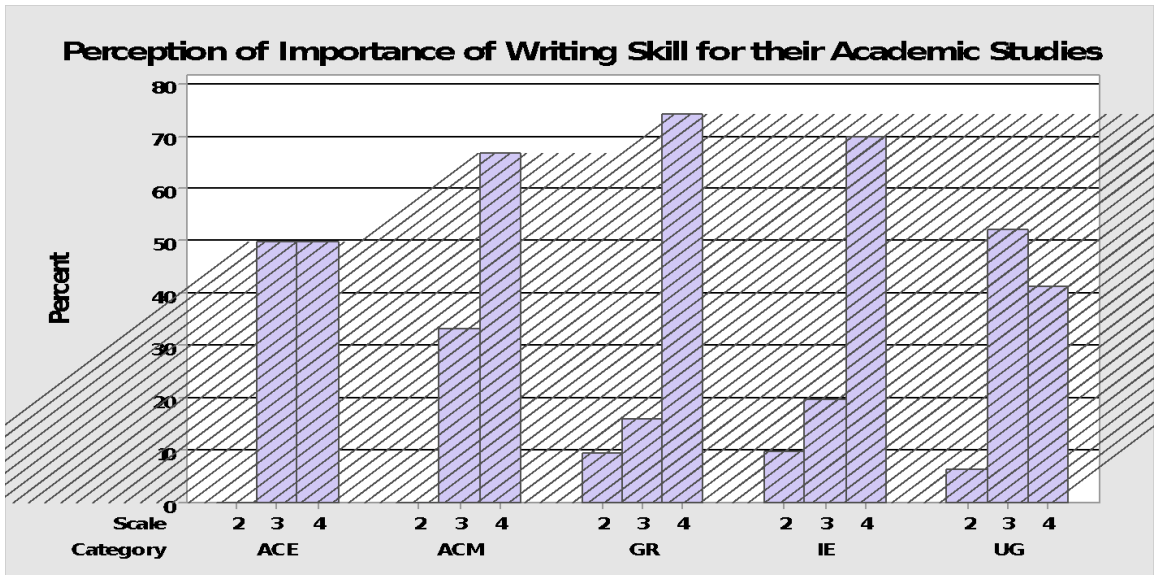
Figure 2: Importance of Writing Skill for Academic Purposes

ACE	-	Academic Staff English,	Very important	-	4
ACM	-	Academic Staff Mechatronics	Quite Important	-	3
GR	-	Graduates	Not very Important	-	2
UG	-	Undergraduates	Not Important	-	1
IE	-	Industrial Personnel			

Further majority stated that the fact that they lacked a sufficient amount of vocabulary was the reason behind the hindrance in expression of ideas. Although as per some of the students there is a content of vocabulary which is included in the lessons it does little help in improving writing.

Thus many statements revealed that on the part of the learner too much effort has to be laid and also as in the introduction, the students of Univotec come from a wide range of educational contexts, such as dropping out of school as early as Grade 8.

Thus it was visible that many who stated that writing and angering at exams was tedious came from such backgrounds and due to their less exposure to structured language instruction as essay writing, the performance at the examinations hence resulted to be "Poor". It was not only at the examinations that the students found "Writing" to be difficult but also during lectures "Note Taking" was also somewhat difficult due to poor English writing skills.

Expressions at the interviews highlighted that lack of good writing skills and a sound vocabulary hindered their expression of ideas not only at the exams but also in writing assignments and project reports based on the industrial experience. According to the students although an area namely project writing is addressed in the first year of the English module, however this is said to be forgotten in the following years with the engagement in industrial training and the other main modules.

While some exaggerated reading and writing skills for a minority, knowing the practical aspects of Mechatronics was sufficient in helping to get through the exams and the statement below supports the fact further. Reading was also perceived as important at exams especially to read and comprehend the questions. While writing in English was highlighted as somewhat challenging, reading and understanding the questions was also considered tedious. The chart below displays the importance it had on the undergraduates.
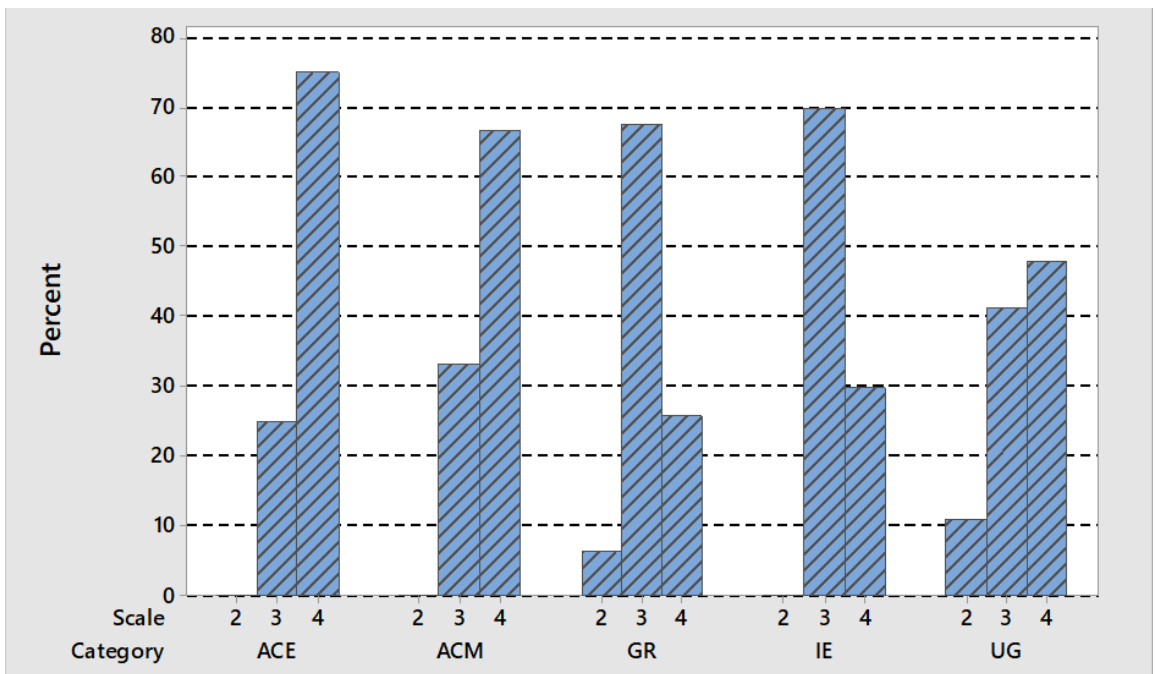
Figure 3: Importance of English to the Undergraduates

English and Lectures

Although listening was not favored by a large majority many have expressed it to be as challenging as the other skills in trying to comprehend the lectures. Except for one or two lecturers who were said to be bilingual, all the other lecturers used English as the medium of instruction. As the staff consisted of two foreign lecturers the students had no choice but to listen to the lecture no matter how difficult it was. While it was difficult comprehending the lectures of the two foreigners as per most students it was stated as a good experience as with the local lecturers they would be able to ask the meaning in Sinhala without giving much effort in learning the language but with the two foreign lecturers they were forced to understand no matter how difficult it was.

English and Presentations

The study also revealed the perception of the undergraduates towards the skills of speaking in the academic context and the Figure 4. displays their views. Among the four language skills Speaking was largely favored and was also one of the most needed skills in the academic context.
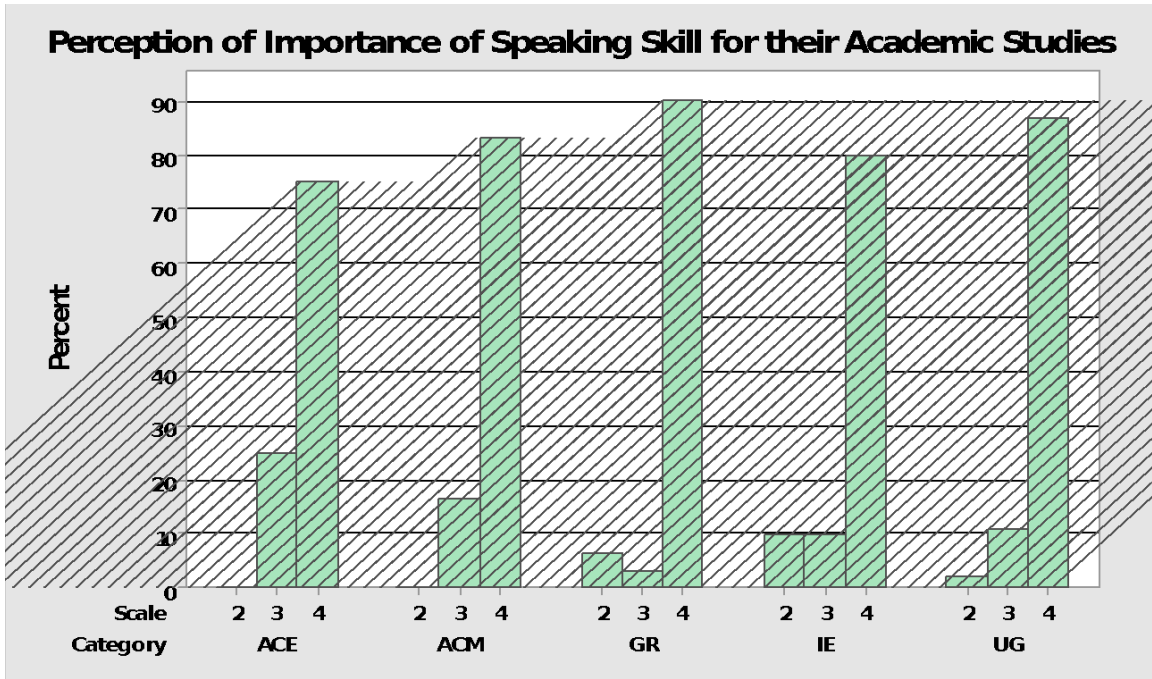
Figure 4: Importance of Speaking Skill for Academic Purposes

For many, presentation or speaking in English was highlighted as important yet challenging, especially as the majority of the students found it difficult   to express their opinions during the time of presentations. Although the current "Communication Skills" module does concentrate on presentation skills during the first year, as the undergraduates take the first year lightly and are not focused many miss out on useful hints given on doing presentations. The responses of the undergraduates also stated that the time allocated for them for doing presentations was insufficient to train the students in reaching their objective of making effective presentations. In addition, as the presentations for the English module are based on more general topics such as "poverty" the student did not see how such topics were relevant to the industry. They did not invest in general topics as they could not provide the skills they thought they needed for the workplace. Thus the need for more subject related topics in presentations was strongly emphasized.

As per one of the undergraduates, it was highlighted that the need for skills such as asking questions were not incorporated in the current "Communication Skills" module and this was exaggerated as very essential in order to proceed with the subject related modules. The above experiences highlight that though there was a need for speaking in the academic context there were insufficient activities to encourage an active English speaking environment in the current module.

Summary of Perceptions

Thus the majority of the expressions of the undergraduates highlighted that possessing solid English language skills will contribute to reducing the student dropout rates at Univotec. The views that were brought out in three of the key areas of the academic context: Examinations, Lectures and Presentations as displayed above further highlighted perceptions held by the undergraduates on English.

As per the views of the undergraduates the need for English was strongly felt especially during the second year with the industrial exposure as they were expected to move with undergraduates of other universities and communicate with the hierarchy of the company in English . Thus it was stated that it was at this point of the university life the undergraduates realized how far behind they were, in terms of the English language, compared to undergraduates from other universities during their industry training.

The undergraduate views also exaggerated that poor English language proficiency affected the grades of the undergraduates as many were compelled to miss a batch or drop out of the program entirely. This was clearly seen in the year 2014 where as per the statistics obtained from the university although 58 students were registered for both full time and the part time degree programs, but in the year 2012 only 7 graduated.

The responses also revealed that in order to move from the first year to the following year a good command of English was needed due to the advanced content of Mechatronics modules taught in the succeeding years. This was also highlighted to be essential due to the link between the theory and practical modules.

A noted factor was that the marks of the students were at an alarmingly low level and the following statement further expresses the reason for such unsatisfactory attendance.

Macalister (2010) states that it is the responsibility of the teacher to make a course as interesting and as motivating as possible. Therefore, more attractive teaching methods and lesson planning can help in shaping students' attitudes towards learning.

Conclusion

The above results have come up as a part of a research that was carried out which was in the hope of designing a new English program for the undergraduates of Univotec. In this study the researcher has looked at the perceptions of the undergraduates on English Language Skills in relation to their academic context. The result of the current study lends itself for the improvement of the current Communication Skills module carried out to help the undergraduates of Univotec to face the main modules related to the degree and in this it is the Mechatronics degree.

What was evident from the views of the undergraduates was that Communication Skills consists primarily of EGP related content. The module which is introduced to support undergraduates to uplift their English language proficiency has not accomplished its goals nor met the requirements of the undergraduates.

The participants exaggerated on the incorporation of more activities related to the four skills which was found to be lacking in the current syllabus. Content of "Writing " was criticized as it only contained areas such as essay writing and letter writing, which did not complement

the requirements of the industry. Thus more task oriented writing activities such as report writing based on industrial needs, writing official and unofficial emails, filling forms and logs, memos, procurement documents lab report was suggested to be incorporated. With regard to "Reading" there were suggestions to include more reading materials that would train the individuals at the examinations and reading of materials such as manuals, e-mails, letters and procurement related documents at industry level. The lack of a focus on technical terms in Communication Skills is a noted drawback in the current curriculum. Technical vocabulary is required both at the academic context and at the industry. A strong recommendation to incorporate technical terms was hence highlighted from the study.

There was a strong recommendation for more activity based learning that includes role plays, individual and group presentations, public speaking and to be included in order to enhance the students' speaking skills so they can communicate confidently in real life contexts that require them to communicate in English.

The findings further suggested that the use of authentic material that is specific to mechatronics to teach all four skills. This requires handouts to be based on Mechatronics related content. This is expected to enhance the performance of the main stakeholders, both undergraduates and graduates in the academic context as well as in the target career. As displayed in Table 3 the findings revealed some of the cub skills that need to be addressed through the "Communication Skills" module in the academic context.

As the core of the study was on whether the stakeholders needed a more ESP or an EGP curriculum a larger part of the perceptions of the undergraduates dealt around finding if they preferred the content to be more ESP or EGP. The findings revealed that the existing curriculum did little in helping the undergraduates to perform effectively academically especially with Mechatronics related subjects. The students' responses favored a more ESP curriculum to suit the needs of the undergraduates to aid academically. However further responses revealed that as student's language proficiencies vary from unsatisfactory level to satisfactory level as they come from diverse educational backgrounds an ESP curriculum alone would not be beneficial.

Thus many suggestions were brought out to use an English module with a blend of EGP and ESP. As Zohrabi (2015) highlights, EGP is a foundation course in any curriculum which is intended to pave the way for English for Specific Purposes (ESP) thus this is an inspiration to use both EGP and ESP to effectively carry out an English language module to the undergraduates of Univotec.

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Interactive Courseware Development for Learning the Algebra Competition in the Materials of Learning Mathematics

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Abstract

The purpose of this study is to design, develop and test the functionality of a learning tool that is more interesting and effective for the subject of Algebraic Expressions in the subject of Mathematics. The developer used an interview instrument to collect data to identify student concerns consisted of three experts which is two (2) Faculty of Technical and Vocational education (FPTV) lecturers, Universiti Tun Hussein Onn Malaysia (UTHM) and one (1) from Sekolah Menengah Kebangsaan Seri Gading. The analysis shows that the three experts agree on the interactive textbook for learning Algebraic expressions in the Form One student mathematics subject to these three multimedia application designs where the experts provide positive feedback in the content design section content, interaction design and interface design. Overall, the development of an interactive textbook for learning Algebraic Expressions in this one (1) Year 2 student mathematics subject is acceptable for the T&L process.

Keywords: Teaching and Learning Prcess, Algebra, ASSURE Teaching Model, Universiti Tunn Hossein Onn

Introduction

The development and use of multimedia especially in education is not a foreign matter in Malaysia. Therefore, in the context of education, interactive use of multimedia has played an important role in enhancing the teaching and learning process (T&L) in a more effective and quality way. In addition, multimedia technology is said to have a profound impact on communication and education (Ahmad, Aris & Harun, 2005). A variety of teaching aids can be provided for a particular subject to facilitate student's understanding. Interactive concepts in multimedia are said to overcome the constraints inherent in the traditional T&L method where conventional learning environments provide little opportunity for students to actively participate in the learning process in the classroom (Suryadi, 2009).

The application of animated elements in multimedia applications is very important for the purpose of the T&L process compared to other elements. Animation is seen as being able to attract users or students and thus motivate students (Sidi, Junnaini & Malajad, 2005). Therefore, students' lack of understanding in Mathematics subjects needs to be solved by developing a more effective method using multimedia software. These Math Concepts are learned at special times and are integrated into all thematic learning activities using fun methods to stimulate students' thinking. Therefore, mastery of Mathematical science is essential to provide a workforce that is compatible with the development and needs of developing a developed nation (Johan, 2008).

Interactive Courseware in Education and Learning

The use of the textbook in education is an effective initiative to create student interest in learning Algebraic expressions in Mathematics subjects during the T&L process in the classroom. The use of textile as e-learning also creates awareness and enhances students' attitude towards the role of educational technology in developing knowledge and educational progress (Akmal, 2008). In addition, the ability of interactive multimedia tools to help students master skills in Science, especially Biology, has received serious attention over the past two decades (Hartshorne & Cypher, 2004). Therefore, to achieve educational goals in Malaysia, a paradigm shift is required in the thinking and use of technology (Noordin, 2011). Efforts need to be made and engagement should be done to the extent that we can afford them and produce something according to our own thinking, without relying on others.

Courseware containing a combination of text, graphics, animations, audio and video is essential to attract students' attention in T&L sessions. The existence of the workforce in the educational environment has shown a new development that is expected to help the education world become more effective through the T&L process (Yusoff & Tanalol, 2005). Computer-based tools can make the educational process a fun and exciting experience while helping students understand a concept quickly and easily.

Courseware is an effective educational medium and the advantage of the media compared to other media is clear. Courseware is able to integrate a variety of media, text, voice, images, graphics and animations in one digital environment. It enables interactivity with students. As with other educational media, textiles are tools, methods and approaches used to make teacher-student communication during the process (T&L) more effective. Thus, the existence of these tools can also reduce the burden on teachers in the provision of teaching aids (ABBM) and their delivery. In addition, the presence of the teacher in the learning process is timely and the benefits can be felt while also creating students' enjoyment of learning in the classroom.

Mathematics Curriculum Approaches in Education

Mathematics is often defined as a study or study of structure patterns, changes and spaces or in other words, studies of numbers and diagrams. According to Idris, Abdul and Asmah (2010), Mathematics is a field of knowledge that trains the mind to think systematically and systematically in solving problems and making decisions. Mathematical learning is integrated with Science, Social Sciences, Health and other fields. Additionally, the Math

program should allow students to use Math as a tool to explore, discover new discoveries of 'Discovery' and solve problems.

The mathematical development of pupils begins with the student's experience of concrete objects or objects containing quantities and qualities of objects such as different colors, sizes and shapes and manipulating the numbers around them. According to Hergenhahn and Olson (2009), every normal child is able to understand Mathematics well when their activities and methods are given their attention. Mathematics is an example of logical thinking that shapes the concept of children's numbers that requires experience, social interaction, time, language and understanding of student thinking (Eat, 2011).

Algebraic Expressions in Mathematics

According to Sangit (2007), Algebra is part of the Mathematics field where it is involved in the areas of relatedness and function. In Malaysia, topics related to the field of Algebra have been studied informally since elementary school. The continuity of this field of Algebra was formally studied at the high school level. He added that it is common knowledge that the field of Algebra is the connection between letters in a single equation or expression.

In addition, Sangit (2007) argues that students need to change their thinking in the area of Algebra because so far students have only studied Maths related to arithmetic. However, when students are in high school, the field of Algebra is part of the topic in Mathematics. According to Martínez et al., (2002), although Algebraic thinking and some important Algebraic concepts were first learned in early grades, there are still many students who find Algebra difficult to understand.

Research Objective

The objectives of this study are as follows:

i.   Designing interactive courseware for learning Algebraic Expressions in Form One student mathematics subjects.

ii. Developing interactive courseware for learning Algebraic Expressions in Form One student mathematics subjects.

iii. Evaluating the usefulness of learning Algebra Expression courseware by experts.

Methodology Of The Study

In the process of developing a learning courseware based on the teaching design model, Heinich's (2002) teaching design model was selected as a guide for developing this courseware. ASSURE models are also known as classroom-oriented models. This model was developed to create effective and efficient T&L activities, especially in teaching and media-based teaching activities. There are six (6) elements in the ASSURE Model like the diagram below to develop this learning courseware as a progressive process.

Figure 1: ASSURE Model of Heinich (2002)

Student Analyze Phase

The analysis phase is to analyze all existing student characteristics such as general description of age, level, background and so on. By knowing these features, developers can become the basis for the selection of media and materials later. This process should examine student records and interact with students directly. Level-specific competencies are related to students' existing knowledge and skills in the subject and student content. This information is obtained from interviews with teachers as well as student interactions where this model is a good process for understanding the characteristics of the students. It makes it easier for developers to create instructional materials based on the students' wants and criteria, by interacting with students, more about the student's problems.

State the Objective Phase

Well-organized teaching objectives can lead teachers to achieve the desired result. The objectives provided should be realistic and in line with the student's level of ability. Instead, they need to be structured from simple to difficult such as for example in Mathematics, which requires a lot of practice and a high level of focus from students. As the education age is advanced, learning in the form of courseware development facilitates students to better understand and engage students, indirectly the objective of measuring measurable student engagement and the state or diversity and level of student achievement facilitates the achievement of objective objectives.

Material Use and Resource Source Phase

In this phase developers should set up the use of materials and media used in the process of developing interactive courseware for learning Algebraic Expressions in Form One student mathematics subjects. The source of media use and materials in teaching is important as it determines the effectiveness of the teaching and learning process of T&L. When

implementing the T&L strategy, developers need to provide appropriate teaching media to help students understand the content of the lesson to attract students to focus more on the T&L process.

Student Engagement Phase in Learning

The fifth phase requires student involvement in learning. Student involvement in the T&L process is a priority and is always encouraged by educators. In designing this learning courseware page, students are involved in contributing to the environment that allows students to control their learning. For example, students are given the freedom to choose what multimedia elements they want to incorporate into their learning environment. Next, students are provided with interactive courseware whose variables can be controlled by the student. In addition, observation sessions were held, discussions and comments for feedback on the software being developed. This is important to ensure that the application is appropriate, effective and engaging.

Evaluation and Modification Phase

The evaluation and revision phase is the final step in the ASSURE model. Completed software is evaluated to get feedback from the user and the teacher and to ensure its usefulness through interviews. This phase is intended to determine if there are any weaknesses and defects in the software to be immediately repaired to meet the needs of the user.

Findings

Developers have been testing and evaluating the development of interactive courseware for learning algebraic expressions in their Form One student mathematics subjects. As a result, developers conduct testing and evaluation through expert verification. Through the testing and evaluation process, developers are able to measure product feasibility of product content design, product interaction design and interface design. Experts have been given expert reviews to review the product development functionality that developers have developed.

Expert Testing for Content Design

This section is based on the content of the content contained in the interactive courseware for learning algebraic expressions in the Form One student mathematics curriculum developed. There are six question items asked by experts in this section. Through analysis, the percentage of each question indicates that all experts agree on the whole question. The conclusion that can be drawn is that the experts provide positive feedback on the questions in the courseware content section.

Table 1: Table of Contents Design Table

No.	Item	Frequency		Percentage (%)
		Yes	No	
1	Will this courseware help to attract students?	3	0	100
2	Is the information related to Algebraic expressions easy to understand?	3	0	100
3	Does this courseware show less information?	3	0	100
4	Is the learning description clear?	3	0	100
5	Is the explanation in this courseware clear?	3	0	100
6	Does this learning application display Short Information on Algebraic Expressions?	3	0	100

Expert Testing on Interaction Design

This section is based on the interaction design aspects of the interactive courseware for learning algebraic expressions in the Form One student mathematics curriculum developed. There are questions asked by experts in this section. From the analysis that can be made, all the questions indicate the positive aspects of this interaction design. All experts agree that this interactive learning courseware works well and can provide convenience to users. However, one of the experts disagreed for the exit button to work properly.

Table 2: Evaluation of Interaction Design

No.	Item	Frequency		Percentage (%)
		Yes	No	
1	Does the use of the words on the button / icon facilitate the user?	3	0	100
2	Do the buttons / icons found in this interactive courseware work well?	3	0	100
3	Does the home button work properly?	3	0	100
4	Does the exit button work properly?	2	1	66.7
5	Can this interactive learning courseware provide convenience to users?	3	0	100

Expert Testing on Interface Design

This section is based on the multimedia element interface design features found in the interactive courseware for learning algebraic expressions in the Form One student mathematics curriculum developed. There are six question items asked by experts in this section. Through analysis, the percentage of each question indicates that all experts agree on the whole question. The conclusion that can be drawn is that the experts are responding positively to the questions found in the courseware interface design section. However, one of the experts disagreed that this interactive learning courseware could attract users.

Table 3: Evaluation of Interface Design Table

No.	Item	Frequency		Percentage (%)
		Yes	No	
1	Does the interactive learning courseware produced have the right color combination?	3	0	100
2	Is the text color used in this courseware compatible with the background color of the screen?	3	0	100
3	Is the text size used in the presentation of information appropriate?	3	0	100
4	Is the text font used in the presentation of information appropriate?	3	0	100
5	Is the background music used in this interactive learning courseware appropriate?	3	0	100
6	Do interactive learning courseware have multimedia elements that attract users?	2	1	66.7

Expert Confirmation

Developers have developed expert endorsements for interactive courseware for learning algebraic expressions in their Form One student mathematics through a specialist verification form released by the university. The expert information, insights and reviews provided on this product are suitable for the purpose of the university teaching and learning process.

Next, the expert endorsement consisting of one of the school's teachers is a teacher in Mathematics and two lecturers from the Creative Multimedia field to test and evaluate the feasibility of this product once it has been developed. Developers receive feedback, insights and reviews from experts on the interactive courseware functionality for learning algebraic expressions in Form One (1) student mathematics subjects such as Table One that can help make this product better and meet the requirements.

Table 3: Evaluation of Interface Design Table

Expert	Expert Position	Views and Reviews	Developer Action
1	Lecturer in Engineering Education Department Faculty of Technical and Vocational Education, UTHM.	Overall I am satisfied with the design and development of the product. However, there are some improvements that can be made. i. The video needs to be purified which are steps in the operation and the letters must be bold. ii. Activities should be completed by solving them by showing them the way	In addition, it creates a clearer and purer path to activity.

Expert	Expert Position	Views and Reviews	Developer Action
2	Senior Instructor of the Department Vocational Education. Faculty of Technical and Vocational Education, UTHM.	i. The animations on the 'click the menu below' need to be removed and only be static. ii. The exit button just to exit the courseware needs to be standard. iii. Reduce unnecessary animations as they distract users.	Improved animation on courseware and exit button has been changed to standard.
3	Seri Gading National High School Math Teacher, Batu Pahat.	i. Provides a more interactive interface and graphics. ii. Back button to return to the topic page. iii. Make sure the next button is locked to prevent other interfaces. iv. The content meets the topic you have selected.	Improved the interface to make it look more attractive and the back button was placed to make it easier for users and the next button was locked to not go to another page.

Discussion

Based on the findings and analysis of the data obtained, the discussion covers the questions developed by the developer, including the development of interactive courseware design for learning Algebraic expressions in the Form One student mathematics subject and includes expert verification after testing and evaluating the functionality content design, interface design and interaction design.

As a result of the analysis performed on the experts, the three experts agree that content design is in good standing throughout the process of communicating the objectives and the layout of the content can contribute towards achieving that objective. This is supported by the statement of Mahmud, Ismail and Hassan (2007) that the development of a good software should include several features including objective content as well as neatly organized information on display. In addition, all experts agree on content design when content meets the syllabus for the Math subject for Algebraic Expression topics. Also, the content on each display is also easy to understand. Furthermore, all experts agree on the use of graphics, animations, and audio for this courseware. Students' ability and understanding of a theory and practice is faster and clearer with the presence of multimedia elements that help to give a clear and engaging picture (Mayer, 2009). In addition, to test the students' comprehension a number of objective quiz questions were developed by the developer for student response.

Additionally, based on the results of the analysis, all experts agree on the use of button/icon function items that are easy to identify and that there are several buttons that use words to make it easier for the user to determine the user's control over communicating or interacting with the computer. The results of this analysis are also supported by the findings of Mahmud, Ismail and Hassan (2007) that the interaction design of a good software should emphasize several things such as the design of the built-in button that should be consistent throughout the software used and easy to identify by the user - easily identifiable by the user. In addition, to achieve the right information on each designed screen, it gives the user control over the original display after being on the other screen and is flexible for the user when they want to exit the display whenever they want, as well as contribute to the design good interaction. The results of this data analysis emphasize that aspects of interaction design are also supported by the findings of Ali, Eh Phon and Che Lah (2007)

that button/icon requirements are important and that each display should have a similar and consistent button to the next view. This button makes it easy for users to move from one view to another by selecting the desired menu.

Based on the discussion on interface design, most experts have responded positively to the aspects of interface design contained in the development of this interactive learning video. The findings of this analysis are also supported by the statement of Tasir, Harun and Alip (2008), that the production of good interface design should be supported by appropriate text, graphics, animation, audio and color elements. Next, the positioning of the elements is based on the description of a user's eye movement, which is that a user's eye movement starts at the left side of the computer screen, then the user goes to the left-hand side of the computer screen, and then horizontally to the right side of the computer screen.

Conclusion

This study aims to develop an interactive teaching courseware for Mathematics for the topic of Algebraic Expressions as an additional learning resource for Form One students. In addition, a more detailed Algebraic Expression process can be explained to students through courseware. As such, the development of this interactive learning courseware is also a learning alternative for student reference and incentives for independent learning beyond T&L time.

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Initiatives of CPSC Member Countries on Industry Institute Linkages

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Abstract

Across the globe, TVET is being positioned as strategic assets in innovation and economic competitiveness, and as problem-solvers for socio-economic issues affecting their countries and therefore there emerge the need for strategic partnerships between TVET institutions/TVET Institution with industries that go beyond the traditional funding of discrete research projects. Therefore, it is implied to have sufficient ground to undertake the study on this important and vital issue in sixteen CPSC member countries. The purpose of this research is to examine and discuss the status of Industry Institute Linkages in the TVET system of the CPSC member countries. The goal of Institution-industry collaborations is to fully capitalize on the potential of both parties while simultaneously satisfying the mission and objectives of each partner. Here, the quantitative and qualitative approaches were deployed to conduct the research by collecting the data from the primary, secondary and tertiary sources through closed ended questionnaires. In order to analyze the qualitative data, the content analyses method is used to analyze the responses.

Keywords: TVET, Industry-institute linkages (IIL), TVET Policies, TVET Programs, Employability, Public Private Partnership, Apprenticeship training, dual training, CPSC,

Introduction

In the era of globalization and digital technology, competition among industries has become stiff and people look up to TVET Institutions to solve their problems. There is an urgent need to prepare TVET students for jobs in multinational companies, by exposing them to newer technologies and engineering methodologies, in order to respond to the needs of industry and labour markets. The trained workforce being a backbone of the regional economy, is indispensable for enhancing productivity, enterprise competitiveness and sustainability.

These objectives can only be achieved well by bridging the gap between industry and institution/Institution. Therefore, the vision, flair, energy and commitment from everyone engaged in the partnership is required to nurture the spirit of partnership and thereby for building healthy and vital economies and communities. It is thus necessary to focus to explore the current interpretations of industry institute linkages in the sixteen members countries of CPSC (Afghanistan, Bangladesh, Bhutan, Fiji, India, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, and Thailand), since it has a great impact on quality of education, employability and regional economy.

With this background in mind, this research has been undertaken to emphasize the inevitable importance of the industry institute interaction as a vital tool to bring the desirable change in the TVET sector in the jurisdiction of CPSC member countries. In this research design the data used is obtained from survey, questionnaire and primary, secondary and tertiary sources including the one obtained through different search engines to draw certain useful and relevant conclusion cum recommendations that may help in policy formulation for enhancing the quality and effectiveness of industry institute interaction.

Statement of the Problem

The linkage between industry and institutions is of great significance for improving degree of relevance of contents and delivery of TVET systems, in the context of the changing global economic scenario in the region. Institution-industry collaborations pair the discovery and dissemination of knowledge such that the knowledge gained can be applied to the creation of goods and services. Properly constructed, these collaborations ultimately endow society with a public good far exceeding the combined contributions of the parties: economic growth, an improved standard of living, an extension of humanity's intellectual reach. In the broadest sense, the goal of Institution-industry collaborations is to fully capitalize on the potential of both parties while simultaneously satisfying the mission and objectives of each partner. In short, it transforms the role of the research Institution for the 21st century, anchoring it as a vital center of competence to help tackle social challenges and drive economic growth.

However, the present TVET system is still based on all old assumptions and models and therefore needs a radical shift in its design and future strategic goal to cater the present demand of the industry. In today's era of globalization, technological advancement is responsible for many vital changes in the industry and labour market. Thus, TVET graduates need to cope up with this challenge by enhancing their skills and competencies for their survival through systematic efforts.

It is seen that this area of industry institute linkages has not yet received the proper attention, may be due to several factors and thereby very little evidence of the research in this domain is seen. Therefore, to address this important issue, it is necessary to look at the present policies and legal provisions and their impact on the existing TVET program which have the focus on the issue. Similarly, it is equally important to study the composition and structure of curriculum in the member countries that are updated with the intervention of industry using industry institute linkages. As there are many constraints in implementing the successful interaction between industry and academic institutes, it is worth studying these challenges that are encountered in its implementation and then the solutions to resolve these challenges. It is quite possible that in some countries, the industry institute interaction may be successful, but there is always scope to improve such a system further and hence it is necessary to seek the feedback and/or suggestions from the TVET experts.

Therefore, an attempt has been made here in this paper to examine and analyze critically the present status of industry institute linkages in CPSC member countries to come across certain conclusion/s that may help in policy formulation, enhancing employability skills through relevant competencies and creating further the stronger bond between industry and institute.

Objective of the Study

The main objective of the study is to find out the current status of industry institute linkages in TVET sector in CPSC member countries and to determine the various avenues such as new innovative policies, integrated curriculum, dual training model etc. to offer some recommendations based on the certain conclusions drawn through analysis of its present status. These findings may be further used by the competent authority of the respective country, for suggesting the necessary reforms to enhance the industry institute linkages in the area and to correct or modify the relevant regulation, if required.

Research Questions

The following are the research questions formulated for this study.

1. What are the present policies and legal provisions related to industry institute linkages?

2. What are the TVET programs focusing on the strong industry institute linkages?

3. How is the composition and structure of curriculum updated with the intervention of industry using industry institute linkages platform?

4. What are the major challenges to enhance industry institute linkages?

5. What are the suggestions would you like to give to strengthen the industry institute linkages in your country?

Review of Related Literature

Since the role of TVET is changing significantly to address the needs of emerging industries, the training system needs to address the training needs of these emerging industries. The present and emerging scenario of partnership linkage observed in the CPSC member countries has been discussed below.

Bangladesh

In recent years, the Government of Bangladesh has initiated a number of measures to introduce more PPP projects across sectors. NGOs such as the Underprivileged Children's Educational Programs have developed strong linkages with industry. Another example of private sector-facilitated TVET is a garment workers' education program established by the Bangladesh Garment Manufacturers and Exporters Association, UNICEF, and the International Labour Organization (ILO) that provides basic and vocational education to children who were former child labourers in the garment industry. Its main function is to "increase the efficiency, productivity and product value of the industry." (ADB, 2017). The following three summaries highlight examples of PPPs in TVET are cited below:

The Chittagong Skills Development Centre: The Chittagong Skills Development Centre (CSDC) is the first industry-led, non-profit skills training centre which strives to strategically develop the country's workforce by catering to information and communication technology, manufacturing, and services sectors' present and future skills needs. CSDC seeks to grow the skilled labour pool by providing high-quality, cost-effective, value-added skills training to its corporate members and other private companies. (Tansen, n.d)

The Centre of Excellence for Leather Skill. (COEL): Recognizing the enormous demand for skilled workers, the Centre of Excellence for Leather Skill (COEL) was established to serve as a one-point resource centre as well as a service provider to develop, support, and strengthen workforce development in the leather sector. COEL's main source of funding comes from the services it offers to the industry and to the labour market.

The Centre of Excellence for Ready-Made Garments. (CERG): A centre of excellence for the ready-made garments sector has been set with a grant received from the Swedish International Development Cooperation Agency and a contribution from the global retail brand H&M to work with trade bodies, such as the Bangladesh Garment Manufacturers and Exporters Association and the Bangladesh Knitwear Manufacturers and Exporters Association, to address skills development issues. Initially, the centre will work with an H&M suppliers' group of around 250 suppliers and may eventually scale up its operation.

India

The TVET landscape has historically been diverse and complicated, with multiple agencies such as the Directorate General of Employment and Training, Ministry of Human Resource Development (MHRD), Ministry of Rural Development, and nearly 17 other ministries engaged in education, vocational training, technical training, and skills development. The launch of the National Skill Development Policy in 2009 led to the formation of the National Skill Development Corporation (NSDC) in 2009, the National Skill Development Agency (NSDA) in 2013, and the Ministry of Skill Development and Entrepreneurship in 2014. The cumulative capacity of skills development, through all government programs, is about 10 million people per year against a target of 500 million by 2022 (Planning Commission, 2011). The MHRD has brought a revised scheme of the vocationalization of Higher Secondary Education in 2011 which has greater provisions for PPP partnerships and the involvement of industry. The present ADB support for strengthening skills development efforts in the states of Meghalaya, Kerala, and Odisha and have elements of green skills development. ADB technical assistance to NSDA helps to focus the National Skills Qualifications Framework (NSQF) and to build in components of green standards. ADB technical assistance to NSDC helps sector skill councils to develop green skills standards. (Maclean, et al, 2017)

For vocational courses, industry representatives were involved in curriculum development at a national level. Provision was made to involve experts from local industry as a guest faculty to conduct practical classes. Some locations do not have the industries in their area and in such cases a novel concept of Production cum Training Centres was introduced. It also varied with the nature of vocational course, e.g. for an x-ray technician's course, association with a hospital or nursing home is naturally imperative. The conferences are conducted at Pandit Sundarlal Sharma Central Institute of Vocational Education (PSSCIVE), National Council of Educational Research and Training (NCERT) under the industry institute linkage initiative. Apex industry associations such as the Federation of Indian Chambers of Commerce and Industry (FICCI), Associated Chambers of Commerce and Industry (ASSOCHAM) and Confederation of Indian Industry (CII) have been involved to a greater extent in the implementation of vocational education programmes and imparting of skills. The introduction of modular training and multi-skilling, the introduction of competency-based certification for workers without formal training are few initiatives undertaken by the government for the improvement of effectiveness, efficiency and relevance of training. The best example of this industry linkage is a food processing vocational course in Gujarat in collaboration with the All India Food Processors' Association. Some other initiatives

providing direct employment include need-based and tailor-made programs such as a course on insurance with the Life Insurance Company (LIC) of India and a course for Indian Railways. TVS Motor Co. Ltd. is linking up with MSDC to create a trained workforce pool, to meet the challenge in the auto and auto ancillary segment. Recently, a leading German Automobile manufacturer, Volkswagen, started an apprenticeship programme in India based on the dual system of vocational education and training in Germany. Australia is also collaborating with India in various skill development initiatives to share expertise and experiences which is being facilitated through the new bilateral Australia India Education Links website. The website is an information portal which supports education and training collaborations between Australian and Indian education and training institutions, business and industry. The UK India Education and Research Initiative aims to work with a range of different skills and training bodies to enable the participation and facilitation of skill development requirements in both these countries. The New Zealand Open Polytechnic and National Institute of Open Schooling have also signed an agreement for skill development through distance learning. An India-New Zealand Education Council has been constituted to draw up a framework and devise mechanisms of co-operation and set the agenda for improving educational relations between the two countries. NCERT, has executed a 20-month diploma course in English and English Language Teaching under an exchange program with Afghanistan for their youth in 2010-11. (Agrawal, 2013)

The National Apprenticeship Training Scheme, provides opportunities for practical training to freshly pass-on graduates in industries and helps in building a steady pool of talent, which is industry ready; to meet the Human Resources needs of an organisation, at an optimum cost. There is a plan to augment its gross enrolment ratio from the current 20% to 30% in the next five years; to support the requirement of the industry for more than 250 million additional skilled manpower by 2025; to become a stronger hub for attracting global learners from across the world and efforts to move up on the global ranking of universities—these are just a few goalposts that offer the universities an opportunity to reconsider the potential key enablers for success. (Ganesh, 2016)

Malaysia

In Malaysia, its economic development is attributed to many innovative models and good practices being followed in building the effective industry-institution linkages. The basic objective of Malaysia training policy, as established in the Second Outline Perspective Plan, 1990-2000 is to create a strong basis for education and training in order to prepare the economy for global competition. There are few initiatives adopted under the Plan that cover the industrial attachment of trainers and the sharing of public/private sector facilities and instructors, especially through the skill development centres set up in various States. One example is the Penang skill Development Centre for the electronics industry, which is based on a partnership between the State, private enterprise and institution. The centre was established by multinational enterprises and the Penang State Government and is managed as a business by a management council composed of public and private sector representatives. The State Government provides financial incentives, industry shares resources and expertise, and the SMEs make a commitment to transform their technology and operations. (Kulanthaivel, 2016)

Another example is implementation of dual training systems w.e.f.2005, to meet the new demands on the skilled workforce, namely for knowledge-workers or 'k-workers'. In this

scheme, the trainee or worker will spend 70-80% of their time at the workplace and another 20-30% in a training institution to learn theoretical foundations. The training would be for a period of four semesters. There are two implementation approaches. The first one is accomplished through a day-release approach, where the trainee/worker spends 3-4 days per week at the workplace and 1-2 days at the training institution. The other approach is a block approach whereby a trainee/worker spends 3-4 months at the workplace and 1-2 months at a training institution. The employers give trainees/workers monthly allowance. On the other hand, employers are given reimbursements from the HRD fund or tax incentive. After completion of four "semester" programme, apprentices are awarded the NDTS k-Worker Certificate.

Nepal

The Kathmandu Metropolitan City pioneered private sector involvement in the municipal sector with the Private Sector Participation Program as far back as 1999-2000 for institutional strengthening of the city. Several projects or ventures were identified for implementation, such as the Gongabu bus park, construction of footbridges at different locations, and operation and management of Dharahara and its surroundings. The Council for Technical Education and Vocational Training (CTEVT) and the Federation of Nepalese Chambers of Commerce and Industry have established a PPP to develop nine "Prashikshan Kendras" (trade schools). These schools provide training to develop employment-oriented skills. In its 2011 White Paper on Public–Private Partnership, the National Planning Commission introduces three main models of PPPs: revenue-based, availability-based, and hybrids. Eligible sectors are any infrastructure or services sector for which the government has responsibility, such as physical infrastructure and social services, as well as the facility and service needs of the government. (ADB, 2017)

Under the description as service contract, support to community-based early childhood development centres provided under Basic and Primary Education Program II, outsourcing the delivery of teacher training to non-state entities and providing the training of trainers from private training institutes by CTEVT.

Another initiative under Demand-side financing, in which the government pays either the private user or the private provider an amount for delivering a public service and the examples includes Manmohan Memorial Polytechnic, Madan Ashrit Memorial Technical School, Tansen Nursing School, Palpa and Bharatpur School of Health Science. First, being currently operated by Manmohan Memorial Foundation in a tri-party agreement with the governments of Nepal and India and CTEVT. The Government of India provides support for buildings, equipment, and workshop facilities, while the Government of Nepal provides grants and student fees for recurrent and operational expenditures. In second, the government provides grants with contributions from the community for building construction, equipment support, and furniture. Third one i.e. Tansen Nursing School, Palpa is being run under a memorandum of understanding between CTEVT and United Mission, and Tansen Hospital whereas fourth (Bharatpur School of Health Science) is run by CTEVT as an "ophthalmic project" in collaboration with the Bharatpur Eye Hospital and managed by Lions Club district chapter. (ADB, 2017)

Pakistan

In Pakistan, Institute Management Committee (IMC) and District Board of Management (DBoM) are responsible for the quality in TVET and play an important role in effective

management of the institute(s) through active involvement of the industry. The generic roles and responsibilities of the committee(s) related to industry institute linkages are to identify local employment opportunities, facilitating enterprise based training (on-the-job, off-the-job & apprenticeship training) and placements of pass outs, organizing seminars, workshops and exhibitions, facilitate career guidance and counselling, promote public private joint ventures for income generation and enhancement of training quality. It is observed that identifying the appropriate enterprise, active industry-institute engagement and facilitating internships, on the job training and even direct employment leads to attraction of students and thus increases enrolment. The VTIW buffer zone, Karachi is the best example of industry institute linkages.

The major responsibility of the Committee is to engage those enterprises/industry stakeholders that can add the most value and to consult other stakeholders to confirm the outcomes of initial consultations, test ideas and gather additional information. The techniques used for this are direct contact, such as interviews and focus groups, or indirect contact, such as questionnaires, surveys and literature reviews.

Potential partnerships have been developed through Industrial enterprises, Sector Skills Councils (SSC), Chamber of Commerce & Industries (CCI), Clusters & Association, Employers/Organizations (services sector). Industry Exposure Visits for learners and regular industrial attachment of teaching staff with relevant industry are the prominent activities covered under industry institute linkages. (Baig, 2018)

Philippines

Don Bosco Mondo is focused on providing training to underprivileged youths, many of whom do not have good basic education. The Don Bosco Technical Institute in the Philippines forms partnerships with a number of Training involves a curriculum adapted to the needs of partner companies. With this model, the school can guarantee competencies that meet employer standards, which is why the Institute has a 98% employment rate for graduates. The German Auto Company Porsche is one of the institute's stakeholders through the Porsche Training and Recruitment Center Asia (PTRCA). PTRCA offers students full training scholarships and jobs at Porsche dealerships in the Middle East upon completion of the training. (Veal, n.d.)

Singapore

The success story of Singapore is based on the managing partnership through an effective governance structure. These governance structures must include ground rules, so that the diverse individuals and organizations working together towards shared goals have a way to reach agreement on difficult issues. (Kulanthaivel, 2016).

Singapore: The Teaching Factory Concept: Teaching Factory Concept, a hallmark of Singapore, which facilitates effective learning in the implementation of broad-based curricula in the first two years and specialist studies in the final year. It is a concept, which adopts a practice, and application-oriented training approach that combines the learning and working environment from which realistic and relevant learning experiences arise.

The Practice and Application-Oriented Approach: In the Nanyang Polytechnic (NYP) Singapore, final year students in the School of Engineering (SEG) undertake industrial project work aimed at providing engineering and design solutions for the industry. The close collaboration with the industry has made possible opportunities for SEG staff and students to work on real-life projects within time and budget constraints, while observing industry standards. A multi-disciplinary team of engineers and final year students on full-time project assignments undertakes these industrial projects. The real-life experiences, which the students will draw from the practice-oriented course, will help them to relate closely to the occupational aspects of their studies and this will help to bridge the gap between industrial needs and training. (Nanyang Polytechnic, 2009)

Sri Lanka

Nearly 61% of the population is below 34 years of age, and the dependency ratio is approximately 61%, posing a big demographic opportunity for the country. (Maclean et-al, 2017). In the 1990s, the plantations were offered to the private sector on management contracts before subsequently migrating to become fully privatized entities except for a few state managed plantations. The telecoms were privatized in the early 1990s. There were several other state manufacturing and servicing entities such as the Ceylon Steel Corporation, the Sri Lanka Insurance Corporation, and the National Insurance Corporation that were privatized in the 1990s.Thereafter, several power plants were established by private sector operatives. During 1993-2009, the country attracted about Ä 3.3 billion US dollar of private investment in infrastructure projects, mostly in telecommunication but also some in electricity and one in the ports sector.

Another, such example of this change is provided by the Mahindra Chinthana which has the vision that states that it will "restructure the education and knowledge systems suitably, so that Sri.Lanka becomes a key hub for knowledge and learning in the world." Representatives of all the business sectors reported that their engagement with TVET is low. Fifty-six percent of respondents from the energy sector and 40% of respondents from the hospitality sector indicated that they provided on-the-job training, whereas overall engagement with TVET remained weak. Among other important initiatives by the Government of Sri Lanka is allowing the higher education sector to private investment and delivery of services.

Though there is no significant example seen in the TVET sector so far, the training through apprenticeship provided, has a long history in Sri Lanka and still functions effectively. Three types of apprenticeship programs exist:

Sandwich pattern: (year 1: 6 months of institutional training followed by 6 months of on-the-job training; years 2 and 3: 3 months of institutional training and 9 months of on-the-job training);

Apprenticeship with short-term prevocational training: (2 months of institutional training followed by variable length on-the-job training of up to 3 years depending on the trade); about 80% of apprentices follow this pattern; and

Apprenticeship with long-term training (termed dual apprenticeship):   consisting of 1 year of full-time institutional training followed by 1 year of on-the-job training. NAITA also arranges in-plant training of up to 6 months for other tertiary institutions

Research Methodology

The questionnaire consisting of two parts (profile of the respondent and specific responses on IIL) and containing open-ended questions has been circulated to the concerned official of the sixteen member countries to get the answers of the research questions along with their suggestions, if any, to enhance the employability in the region. However, only seven respondents have responded and thus the response rate is around 44 %. Therefore, the other supplementary data has been obtained from the systematic literature review. These responses have been analyzed by the researcher to come to certain findings and conclusions.

Results

Present Policies and Legal Provisions Related to Industry Institute Linkages

The analysis of responses from member countries was carried out and has been presented in following table no 1.

Table 1: Survey result on Policies and Legal Provisions related to IIL.

SN	Country	Data Analysis
		From Primary Data
1	Bangladesh	National Industry Policy 2016. • Inclusive growth by creating quality and income-generating employment through industrialization, skill development and export-oriented industry. • Economic Zone, Industry Park, Custer-based Industry, Establishment of Hi-Tec Park & Establishment of Industry through Public Private Partnership. • Permitting for foreign investment.
2	Bhutan	Though there are no specific policies and legal provisions, the TVET blueprint 2016-2026 has been identified as guiding document. Strategy 4 of the TVET Blueprint allows to ensure the involvement of private sector in delivering TVET through the engagement of industries and companies in training programs. The blueprint also requires the ministry to set up Industry Liaison and Publicity Unit. However, not much progress has been made in this front. There is no proper framework for the linkage and incentive mechanisms to encourage industries to facilitate OJT and other practical learning for the trainees. The National Council's TVET Review has recommended the setting up of the Sector Skills Council. TVET draft policy is being reviewed and will be submitted to Gross National Happiness Commission (erstwhile Planning Commission) for its approval.
3	Fiji	There are different legislations available like Higher Education Act 2008 and 2009, Higher Education (Qualifications) Regulations 2010, Higher Education (Qualifications) (Amendment) Regulations 2013, Higher Education (Amendment) 2017, The Fiji Islands National Curriculum Framework 2007, Policy on Technical College of Fiji, National Apprenticeship Training Scheme.

4	Malaysia	There is no dedicated policy or legal provisions pertaining industry institute linkages at macro level. However, there are operational policies to encapsulate efforts at institutions level. These includes Malaysia training policy, as established in the Second Outline Perspective Plan, 1990-2000.
5	Nepal	TVET Policy, 2012, CTEVT Act, 1989 and apprenticeship schemes and establishment of Council for Technical Education and Vocational Training (CTEVT).
6	Pakistan	Apprenticeship Act of 2018.
7	Singapore	The polytechnics and ITE adopt a practice-oriented approach and teaching factory concept for learning and skills-oriented course curricula. Polytechnic and ITE students also undergo internships and industry attachments to companies to gain experience in their chosen field of study.
From Secondary Data		
8	India	Legal entities like Directorate General of Employment and Training, Ministry of Human Resource Development (MHRD), National Skill Development Agency (NSDA) in 2013, and the Ministry of Skill Development and Entrepreneurship are responsible for quality assurance. National Skill Development Policy in 2009 and National apprenticeship training schemes are few to mention. Involvement of industry expert in curriculum development at national level.
9	Philippines	Employers "sponsor" the TVET students and provide equipment for the laboratories and workshops whereas institute have industry specialists who assist with training and assessment.
10	Sri Lanka	Apprenticeship Training is being provided by National Apprenticeship and Industrial Training Authority (NAITA) under three categories; Sandwich pattern, apprenticeship with short-term pre-vocational training and apprenticeship with long-term pre-vocational training (Dual Training)

The above result and data show that though there are some or the other legal framework to govern TVET education, there is no exclusive policy providing guidelines on creating and strengthening industry institute linkages, either a macro or at micro level. This emphasizes the need of such exclusive policy incorporating all relevant criteria to have a significant positive impact on a country's economy.

TVET Programs Focusing Strong Industry Institute Linkages

Table 2: Survey result on TVET Programs focusing strong IIL.

SN	Country	Data Analysis (Programs focusing on IIL)
From Primary Data		
1	Bangladesh	Hospitality Industry, House-keeping & Catering trades,
2	Bhutan	The main feature of TVET program is On-the-Job-Training (OJT) which is of about three months before students complete their course.
3	Fiji	Tourism Sector, Agriculture/Aquaculture, Forestry, Mechanic, Engineering, Carpentry/Automobiles, Community Services are the programs that have relevance of IIL.

SN	Country	Data Analysis (Programs focusing on IIL)
4	Malaysia	Work-based Learning programs at polytechnics and community colleges.
5	Pakistan	Apprenticeship Program for providing opportunity to the students to work in Industry and get the relevant work experience. Sector Skill Councils (consisting of Industrialists of relevant sector of economy) for helping the Academia in various activities including Curriculum development.
6	Singapore	Structured Industry internships programs are compulsory for most courses offered by the polytechnics and ITE. Work-learn programs that involve close partnerships between tertiary institutions and industry through apprenticeship-based training, launched in 2017. Wide range of programs to reskill and up skill the working adults such as Skills Future Series focusing on priority and emerging skills areas, namely data analytics, finance, tech-enabled services, digital media, cyber security, entrepreneurship, advanced manufacturing and urban solutions.
From Secondary Data		
7	Bangladesh	Leather and garments sectors have more relevance of industry-institute partnership.
8	India	x-ray technician's course, automobile and food processing sector are major trades that focus more on industry-institute partnership
9	Malaysia	Electronics program (Penang skill Development Centre) focus more on industry-institute partnership.
10	Philippines	Industry-institute linkages. is more significant and observed in automobile sector, generating employability.
11	Sri Lanka	Energy and hospitality sectors are focusing on strong IIL and thereby boost the economy.
12	Nepal	Infrastructure or construction, nursing and health Science trade incorporate the major advantage of industry-institute linkages.

The above result and data show that more than 60% CPSC member countries are working towards industry-institute collaboration through relevant TVET programs and thus contribute to produce the skilled workforce.

Composition and Structure of Curricula Updated with Intervention of IIL

TVET education is a tri-polar process (teacher, student and curriculum) of which the curriculum is that pole which forms the central point of the educational process as both teaching and learning only take place through the curriculum. Thus, TVET can be vibrant only if it has a robust curriculum, developed on the basis of present industry needs. Therefore, it is essential to understand the composition of the curriculum and the involvement of industry in its design and implementation.

It is observed that most of the CPSC member countries are following the DACUM system to design their curriculum and involve the industries in its design, review and implementation by various ways. These countries have established different entities like industry advisory committees, sectoral skill committees and skill development authorities to achieve this goal. It is also noticed that Competency Based Training & Assessment is nowadays becoming a popular system in these countries. The survey findings are presented in Table 3.

Table 3: Survey result on composition & structure of curriculum related to IIL.

SN	Country	Data Analysis (Programs focusing on IIL)
From Primary Data		
1	Bangladesh	The curriculum is being designed, developed and reviewed by the competent authority in cooperation with Education Curriculum Board.
2	Bhutan	The industry experts are involved in curriculum design and development. Periodic revision of the curricula for all TVET programs based on the feedback received from the industries and the institutes.
3	Fiji	• TVET being recognized as a cornerstone of reform to support sustainable development. • Tertiary education (higher education) covers TVET and university streams with the involvement from government, private, enterprise and civil society including faith-based institutions • The Fiji Higher Education Commission (FHEC) is responsible for quality assurance of the post-school education and training sector and also for the development of the Fiji Qualifications Framework (FQF), the recognition and registration of training providers and the accreditation of courses, qualification levels.
4	Malaysia	Through the Industry Advisory Committee. Industry practitioners are the part of curriculum development committee Industry practitioners are the part of curriculum review committee
5	Nepal	As required by the industry such as construction, nursing and health Science.
6	Pakistan	Sector Skill Councils (consisting of Industrialists of relevant sector of economy) help the Academia in various activities including Curriculum development.
7	Singapore	To keep industry updated on ITE's latest development, as well as to showcase our industry projects, ITE conducts an annual Industry Partnership Forum and other communication sessions with senior management from various industries. Such engagement enables ITE to obtain feedback for improvement and educate industry about ITE's capabilities. Industry members are also represented on the institutions' Board of Governor and the Academic Advisory Committees. They are involved in projecting courses to be launched, curriculum design, providing internship opportunities for students, and giving feedback on graduates' performance in the workforce.
From Secondary Data		
8	India	Modular training and multi-skilling, competency-based certification are the features of TVET Curriculum.
9	Malaysia	Dual training systems are the typical feature in electronics trade.
10	Philippines	The curriculum in the automobile sectors (through setting Porsche Training and Recruitment Center by German auto company Porsche that offer training scholarships and jobs in the automobile sector) involves strong IIL.
11	Sri Lanka	The curriculum in the energy and hospitality sectors are based on strong IIL, thus generating employment.

The above result and data show that more than 60% CPSC member countries are contributing to the industry driven curriculum to increase the employability in particular trade or program.

Major Challenges to Enhance IIL

The analysis reveals that the major challenges faced in TVET education are as presented in table 4 below:

Table 4: Survey result on challenges to implement IIL schemes.

SN	Country	Data Analysis (Programs focusing on IIL)
From Primary Data		
1	Bangladesh	Lack of comprehensive legal provision and policy, lack of clear TOR for OJT, lack of provision for incentivizing the industry taking part in the training delivery and poor monitoring framework. From August 2019, two institutes will be piloting the Dual Training Program in the construction sector through the involvement of two corporate partners, Construction Development Corporation Limited (CDCL) and National Housing Development Corporation Limited (NHDCL). MOUs were signed between the Technical Training Institutes (TTIs) and these companies. These companies will provide 70% of the courses while TTIs will cover 30% of theoretical learning. If these pilot DTPs are successful, the program might be extended to other sector areas.
2	Bhutan	• The challenge is to continue to update the curriculum and training courses to suit the evolving issues such as climate change • Lack of finance and local experts.
3	Fiji	• Inadequacy of governing policies • Lack of initiatives to nurture the linkages
4	Malaysia	• Industrialists reluctance to open up as they think that their openness will harm their competitive edge • Another challenge is that there is huge young workforce which provides the Industrialists with ample choices without spending a penny. • Most industry belongs to IR-2 and almost outdated which is useless for assistance in imparting Technical education • Cost of acquiring new technology for educational purposes is very high

These challenges may be summarized as under –

- Maintaining commitment to the partnership initiative Joint Unit

- Associating with partners that will not be reputation risks

- Avoiding conflict of interests between potential relationships

Preventing unfair advantage another)

- Ensuring accountability & transparency

- Maintaining active and sustainable interest

- Managing partner's expectations & external other stakeholders

Suggestions to Implement/Strengthen IIL

The various suggestions (for strengthening and enhancing the industry institute linkages) that are the outcome of the survey are compiled together and presented in following table 5.

Table 5: Survey result on suggestions to implement/ strengthen IIL

SN	Country	Data Analysis (Programs focusing on IIL)
		From Primary Data
1	Bangladesh	Enhance industry-based private and Govt. sectors and to promote industry institute linkages.
2	Bhutan	(1) Review and improve the existing OJT program, (2) Develop proper OJT framework specifying the roles of the industries in providing the OJTs, (3) incentivize the industry providing OJT, (4) expand the Apprenticeship Program (ATPs), (5) the participating industries (OJT) should be given tax incentive by the government, (6) increase the duration of OJT, and (7) strengthening supervision and monitoring of OJT programs by the institutes. Direct Employment Schemes (DES) has now replaced the ATPs. DES program has provided the opportunity for job seekers to work for two years in various state-owned enterprises, and private and corporate agencies before they are regularized.
3	Fiji	Strengthen the monitoring and evaluation of the courses for all TVET institutions
4	Malaysia	Need of dedicated macro and micro policies as well as legal provisions about industry institute linkages.
5	Nepal	Must have clear/ specific legal provisions
6	Pakistan	Government Regulations clearly defining the rules for providing apprenticeship to students. Research & Development Funds be raised Incentives for replacing old machinery with new machinery / model. Incentives for initiating IR 4.0 and relevant training.

Recommendations

The various suggestions (for strengthening and enhancing the industry institute linkages) that are the outcome of the survey are compiled together and presented in following table 5.

The research study reveals that there is an immense and immediate need to strengthen the industry-institute partnership in these member countries to face today's challenges in the era of globalization, IR 4.0 and technological advancement. This can be addressed by redesigning jointly the curriculum (addressing new ICT based methods such as virtual reality, augmented reality, internet of things, 3D printing etc.) in TVET education meeting the requirements of industries and by providing the practical training or on-job training in industries with suitable assessment and monitoring framework, by promoting dual training schemes, by promoting students' internship program, scholarships and teachers training, by establishing sectoral skill and industry advisory committees at national level having representation from industries and academics under the governing principle of

shared management structure, by providing incentives from the federal government to the industries in the form of less tax, by increasing the research and development fund and by recognizing the relevance of the contribution of such linkages in TVET. However, it is equally important to provide enough financial viability and incentives to all such partners who are ready to create the long-term sustainable relationship in the TVET sector. It is needless to say here that the analysis of the operational capacities of both the partners plays a significant role in making successful collaboration. Thus, there is an immediate need of creating a comprehensive and integrated legal framework to provide the robust industry-institute linkages policies, defining clearly the roles of each party, for effective implementation of these collaboration processes.

Conclusions

For any country to become truly globally competitive, industry and Institution must complement each other. This can be achieved through the sustainable and productive long-term industry-institute partnership by promoting the core mission of each partner and by accelerating the research in relevant areas that is being quickly followed by a suitable assessment framework.

Thus, it is seen from the analysis that the member countries are trying hard to create the conducive environment for enhancing the industry-institute linkages. Accordingly, the curriculum reforms have been made by Bhutan by incorporating the expertise guidance from the industry. Whereas, Fiji has introduced the Fiji Qualifications Framework (FQF), the recognition and registration of training providers and the accreditation of courses, qualification levels. Malaysia and Pakistan has introduced the concept of industry advisory committees and sector skill committees respectively to address the issue of relevance and sustainability of TVET programs including the curriculum reforms. It can also be concluded that the clear TOR (terms of reference), enough fund provision and use of ICT will further improve the quality of TVET in the region through developing the strong linkages between the industry and institution.

Thus, it can be concluded that the CPSC member countries have to plan strategically for strengthening the industry-institute linkages to provide an exclusive leverage to promote local economic development of the country by providing skill and productive human resources to generate competitive advantages who make use of the innovations.

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Status Of TVET in Relation to Industrial Revolution 4.0 in CPSC Member Countries

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Abstract

The purpose of this research is to examine and discuss the Industrial Revolution 4.0 implementation status in the TVET system of the CPSC member countries. The study was conducted in 16 CPSC member countries in Asia Pacific. A descriptive survey research design was used where both quantitative and qualitative methodologies were employed. Data collection methods included closed ended questionnaires. In order to analyze the qualitative data, the content analysis method is used to analyze the responses of respondents. The findings of the study showed that 25% of CPSC member countries have legal policy and framework documents to address the needs of IR 4.0. It is also revealed that 50% of CPSC member countries are directly and in-directly developing new innovative curricula to address the needs of IR 4.0 for the labor market. The findings also identified that all countries are suggesting to build the capacity development programs for trainers as well as to establish new modern labs to address the needs of IR 4.0. The research also suggested that CPSC member countries have to invest strategically to develop innovative strategy towards IR 4.0 and focus on development of new training programs.

Keywords: TVET, Industrial Revolution 4.0, TVET Policies.

Introduction

Changing the skills demand, reforming the implementation of TVET and developing innovative curricula are among the policy priorities of most Asian countries towards their shift towards industrial revolution 4.0. A trained workforce is a backbone of industries and indispensable for national economic development. It is not only required for increased productivity, enterprise competitiveness and further industrialization but it is equally important to maintain the development already achieved.

The world of work is changing day-by-day and experiencing the Fourth Industrial Revolution (IR 4.0). Shwab (2016) provides an example that helps to understand how the industrial revolutions changed across time. IR 4.0 is also called SMART factory, which brings technological breakthroughs such as automation of production processes in industry through the Internet of Things. Hussin (2018) discussed that IR 4.0 is built on the biological, physical and digital world. The new technologies evolve at exponential pace and there is no historical precedent that marked the beginning of the evolution, hence being called disruptive technologies.

In TVET, the focus of 16 CPSC member countries (Bangladesh, Bhutan, Fiji, India, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, and Thailand) is to develop qualification standards and promote flexible learning, training of trainers and development of TVET policy. On the other hand, technological advancements changed the role of TVET and impact on national and international economies and competitiveness. To remain competitive, these countries need to update the TVET system in order to respond to the needs of industry and labor markets.

The purpose of this research is to understand the impact of IR4.0 on TVET and its status in the member countries of CPSC. In order to understand the current setting and updating of TVET practices in line with IR 4.0, necessary data is collected through survey and secondary sources about the policies, new curricula to address IR 4.0 that meet the requirements of IR 4.0.

Statement of the Problem

The technological changes due to modernization have produced a huge impact on modern life and new labor markets. The side effect of which is the eventual destruction of the traditional job market. The fear of job destruction is due to the possible labor substitution in effect of technological change and it has always been present in periods typified by radical technological changes i.e. the First, Second, Third and Fourth Industrial Revolution.

The current TVET system in CPSC member countries is based on different models and was put in place in the past decades. Fragmented attempts in reform and modernization have proven, in most cases, insufficient in addressing the growing gap between conventional TVET systems, the demands of modern life and new labor markets as discussed by WEF (2017).

But there is little research evidence about the existing policies and legal provisions to address the needs of IR 4.0 through the TVET system in CPSC member countries. There is also a lack of researched information about the new curriculum and TVET programs developed to address the needs of IR 4.0. Publications currently available about TVET in line with IR 4.0 include suggestions about what TVET system to achieve, but it often gives little information about the problems which have occurred with their implementation of IR 4.0 policies, or evidence of actual measured achievements.

It is in the light of the foregoing situation that this paper deems fit to critically examine and analyze the impact of IR4.0 on TVET and its status in the CPSC member countries. In order to understand the current setting and update of TVET practices in line with IR 4.0, it is important to collect data directly from the TVET agencies of these member countries through a customized survey. It will help to understand readiness of TVET towards IR 4.0 to develop skills, competencies needed for getting, keeping, and doing future jobs in these countries for the information of the readers.

Objective of the Study

The main objective of the study is to find out the current status of TVET towards readiness of IR 4.0 in CPSC member countries and determine the various resources such as new curricula address the IR 4.0, TVET policies and legal provision to address the IR 4.0, courses that address the IR 4.0 needs and finally challenges and suggestions to impalement IR 4.0 related courses.

Research Questions

The following were the research questions formulated for this study.

1. What are the policies and legal provisions on developing IR 4.0 in your own country? Please cite implemented laws or policies that are agreed by the government and its stakeholders?

2. What are the TVET programs, seminars and conferences related to the implementation of Industrial Revolution 4.0 in the last two years (2017-present)?

3. What are the courses that you can consider under the Industrial Revolution 4.0 category?

4. How is the composition and structure of curricula for these courses and competencies?

5. What are the major challenges to implement programs on Industrial Revolution 4.0?

6. What are the suggestions would you like to give to implement similar program in other countries?

Review of Related Literature

The industrial revolution 4.0 provides scope for many of the basic ideas that had been widely implemented in many other countries such as Europe and the USA. Internationally, many governments have realized the trend and have taken action to react specifically to the impact IR 4.0 has on TVET. Some of the Asian countries initiatives are as stated below:

Technological Change Is Coming: The Fourth Industrial Revolution - Philippines

A labor market intelligence report produced by TESDA to understand and examine the TVET challenges in relation to IR4.0 (TESDA, 2016). In the study, it is discussed that IR4.0 requirements are challenging for the whole TVET sector to develop the changing skills needed. To ready the TVET system of the Philippines in line with IR4.0, the study suggested the following recommendations.

- To review the training regulations in order to meet the changing core skills requirements.

- TESDA must seriously continue and improve the incorporation of the 21st century skills in all Training Regulations.

- TESDA could also develop a system that would provide value to low level skilled workers who can be given opportunities to pursue higher level qualifications thru life-long learning initiatives.

- TESDA must initiate discussions with the industry and other government agencies of the implications of the Fourth Industrial Revolution to human resource development.

- TESDA is to acquire the necessary equipment for its programs to remain relevant with regard to technological requirements.

- TESDA must continue and initiate benchmarking with other countries, especially those that are already moving towards the development of skills and competencies required by the Fourth Industrial Revolution.

- TESDA should look into the Dual Training System as it is the fusion of school and business in educating trainees.

Tvet 4.0 in Malaysia

Malaysia's economy is characterized by a labor-intensive and investment-driven economic growth. As discussed in Tan (2016), the challenges in this investment-driven economic growth are: (1) to attract foreign direct investment and (2) to link the national economy with the international production systems and the global economy. Motivated to convert its present economy to a developed economy with highly skilled workers, the Malaysian TVET system has to transform in relation to IR 4.0.

To achieve this, a TVET 4.0 framework 2018 – 2025 was developed by the Department of Polytechnic and Community Colleges (DPCCE) under the Ministry of Higher Education (MoHE), Malaysia. The objectives of this framework are to provide the economy with qualified and competitive workers, and to train citizens that are capable of being

Figure SEQ Figure * ARABIC 1: Malaysian TVET Framework

absorbed into the investment-economic growth and poverty reduction strategy by ensuring training opportunities to all social groups without discrimination. The framework is a policy document towards IR 4.0. It has 6 thrust areas, 11 strategies and 6outcomes to address the future needs of IR 4.0.

TVET in Thailand 4.0 Policy

The Thai government has developed a 20-year national strategy document called "Thailand 4.0" in relation to Industrial Revolution 4.0. It is a policy document that outlines an economic model based on creativity, innovation, new technology and high-quality services. This will

be used to boost the quality of life. The Thailand 4.0 will be focused on turning Thailand's labor force into `knowledge workers' across 10 key economic sectors (Jones, C., Pimdee, P., 2017).

The Thai government is prioritizing vocational education and training in their "Thailand 4.0" strategy in support of the economic and social modernization of the country. The Ministry of Foreign Affairs of the Kingdom of Thailand plans upgrade occupational standards and professional qualifications, integrate vocational schools and private stakeholders, the role of the private sector in VET as well as the directions towards Thailand 4.0. The Thai Government gives great importance to human capacity building, which is the heart of strengthening national competitiveness as stated in the 20-year National Strategic Plan (Thailand 4.0) and the building of a stable career, as well as the professional image of technical vocational education (MFA, 2018).

Smart Industry Readines Index - Singapore

In 2016, the Singapore government launched its RIE (Research, Innovation and Enterprise) 2020 Plan with a budget of SGD 19 billion. The advanced manufacturing and engineering domain had identified eight key vertical industries for the Plan (National Research Foundation 2016). In 2018, Singaporean companies managed to develop machines that can help make slight tweaks to fully automate hydroponic farms and maximize crop yield (Tay, S. et al, 2018)

On the other hand, Singapore TVET system is well developed and responding to the need of globalization, changing demographics and technological advancements are some of the key driving forces of the future such as IR 4.0.

Made in China 2025 - China

As discussed by Tay, S. et al (2018), China's government launched two actions simultaneously: (1) "Internet Plus" and "Made in China 2025" strategies. Ten major aspects in the sector of manufacturing are prioritized to boost the industrialization of China (China State Council, 2015). In 2018, the Chinese government announced the elimination of rules that required car manufacturers such as General Motors to collaborate with a local company to open factories in China. China anticipates that the move will encourage foreign companies to bring more advanced technologies into China to meet the demands for electric transportation.

TVET In Relation Of IR 4.0 - India

India is emerging as a major economic power and the entire world is keenly watching the way that it will transform itself in the near future. Putarajaya (2017) discussed that the context of TVET in India is changing and TVET providers are encouraged to align themselves to the latest skills standard and curriculum to ensure the Fourth Industrial Revolution is well-understood and learned. He also stated that to make TVET responding to the labor market, India Government has allocated R50 million from the 30 percentage pool fund for TVET to increase competitiveness and improve the caliber of the workforce and the nation's economic development.

Dipak (2018) discussed the relevance of entrepreneurship education to the development of vocational education and training systems in India, with a special focus on Entrepreneurship Education. The result of the study identified that awareness about advanced IR4.0 skills amongst trainees and trainers is very poor. In addition to this, it was also found out that the curriculum needs to be updated with the latest IR4.0 modules and TVET faculties should be empowered through the internationalization of education

Briefly, all the above countries initiatives show that Asian countries are significantly focused on TVET to address the needs of future industry and that can bring many positive impacts to a nation's development.

Research Methodology

The overall objective of this research is to understand and discover how the TVET sector in Asia Pacific region is interpreting the phenomena of IR4.0, what strategy and policy they develop to support IR4.0 needs and what critical issues they face during adaptation. The research employed a descriptive survey research design. It is also based on secondary data collected through literature review on IR 4.0 in TVET. The survey was distributed to CPSC member countries, as mentioned above, through Liaison Officers. Overall, five responses from CPSC member countries are recorded and included in the results. The reason for the selection of this method is that CPSC has 16 Liaison officers working closely with CPSC to improve the TVET sector. Therefore it is easy to collect the required data on IR 4.0.

The instrument for data collection consisted of a structured questionnaire. The instrument has four sections 'I', 'II', 'III', and 'IV'. The section "I" sought information about the rationale, study objectives, research questions, direction in answering and method. The section "II" is required information on personal data of the respondent such as name, country, reporting agency and address. The section "III" contains questions to be addressed by the respondent and section "IV" is specific quantitative data about the indicators of technological advancement in TVET. Out of 16 questionnaires administered to the respondents 05 were retrieved. The return rate was approximately 32%. In order to collect the further valuable information, supplement data obtained from systematic literature review.

Results

Policies and Legal Provisions on Developing IR 4.0

In order to determine the existing policies and legal provisions of TVET organizations towards IR 4.0 to develop required skills, competencies and attitude, data is collected and presented in the graph below.
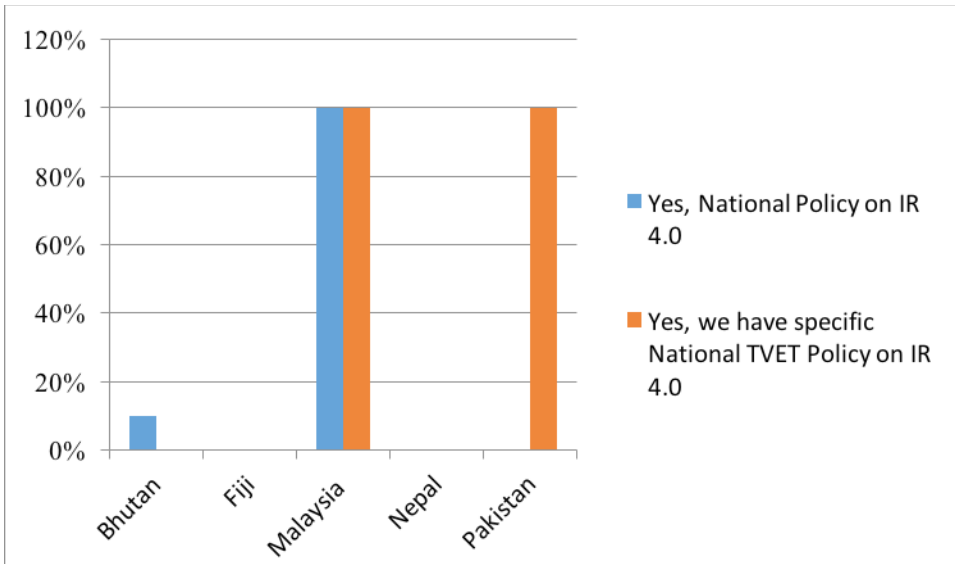
Figure 2: Existing TVET policies on IR 4.0 graph.

The result of the survey was presented in Figure 2. It illustrates that Malaysia and Pakistan have a national TVET policy which addressed the needs of IR 4.0. In Malaysia, the government aggressively took action by undertaking various efforts in helping industry players to embrace IR 4.0 through the implementation of automation and smart manufacturing as described in National policy on IR 4.0.

TVET Programs Related To IR 4.0 in Last Two Years

IR 4.0 is based on the horizontal and vertical combination of manufacturing systems that are ambitious in terms of real-time data interchange and flexible manufacturing. This is to enable a customized production and to support the industry and labor market. There are new training programs that need to be developed in line with IR 4.0 by CPSC member countries.

Table 1 shows that the TVET providers are providing training that meets the industry's requirements including digital skills such as Big Data, Cloud Computing programs, enables TVET graduates to stay relevant and fulfill the country's demand of 21st century workforce in the IR 4.0 era.

Table 1: Survey result on TVET Programs related to IR 4.0.

SN	Country	Data Analysis (Programs focusing on IIL)
1	Bhutan	Refrigeration and Air Conditioner (RAC), Solar Power Training, Mechanical and Electrical related training programs
2	Fiji	Courses to be introduced with the use of technology or computer programming
3	Malaysia	Cloud computing, Big data, Apply open source (Arduino) and drone related TVET programs

SN	Country	Data Analysis (Programs focusing on IIL)
4	Nepal	N/A
5	Pakistan	Artificial Intelligence, Mechatronics, Automation, Robotics, Cyberspace technologies and Internet of things.
SECONDARY DATA		
6.	Thailand	Fit for Industry 4.0 Training Program for Teachers, Robotics and Automation and ICT related courses
7.	Philippines	Lifelong Learning Training Programs (TESDA online Program) • Skills to Succeed Academy • 21st Century Skills Program • Animation (3D Digital) Program • Artificial Insemination Program
8.	Singapore	Worker 4.0 – Digital Readiness Certificate

The above result and data show that more than 40% of CPSC active member countries are working towards industry needs to produce future skilled workers. It also shows that other member countries have to develop IR 4.0 related programs to address the market needs. Therefore it is concluded that more efforts are required to address the needs and requirements of the IR 4.0 industry.

Composition And Structure Of Curricula

Curriculum designs in TVET play a major role in the structure of a TVET system. In particular, teaching and learning in TVET can be directly affected by specificities of the curriculum in use. In turn, this teaching and learning later on reflects on the structure of the industry itself, via essential qualities of its employees. Therefore, it is important to understand the curriculum composition and structure of TVET training programs.

The findings of this study revealed that most of the countries are using DACUM system to design curricula. A further examination of the result revealed that member countries are striving hard to introduce Competency Based Training & Assessment system such as NVQF, Pakistan and Nepal. The survey findings are presented in Table 2.

Table 2: Survey result on curriculum development methods related to IR 4.0.

S.NO	COUNTRY	Curriculum Development Method
1.	Bhutan	DACUM - Develop a Curriculum
2.	Fiji	N/A
3.	Malaysia	Curriculum development process is based on the Outcome-based Education (OBE)
4.	Nepal	DACUM - Develop a Curriculum
5.	Pakistan	DACUM - Develop a Curriculum

The next important aspect of the study is to check that CPSC member countries have integrated IR 4.0 related components into curricula. The survey shows that a majority of the member countries have already incorporated IR 4.0 components to the TVET programs (as also shown in Table 1). The secondary data shows that NAVTTC (2020) Pakistan has developed curricula to address the needs of IR 4.0. For example they developed National Vocational Qualification – Industrial Automation in which the weightage of IR 4.0 elements is 110 hours out of 410 hours. Similarly, the Department of Skills Development in Malaysia also designed and developed a similar course (i.e. Diploma in Industrial Automation). The objective of these aforementioned courses is to prepare the future workforce as technicians and engineers in related industry sectors especially in production and manufacturing industry. 70% percent of the course is fully emphasized on practical training/hands on training. Thompson, F. (2020) on the other hand stated that the Philippines and Indonesia report high shares of the training time dedicated to workplace-based activities to acquire IR 4.0 skills as compared to Cambodia and Viet Nam. He also stated that the curriculum in approximately ½ (50%) of the training institutions surveyed seems to provide courses relevant for IR4.0. Meanwhile the adaptation of IR4.0 technologies themselves in the classroom to facilitate training delivery is mixed.

Major Challenges to Implement Programs on Industrial Revolution 4.0

The findings of the survey revealed that major challenges faced by TVET providers in moving towards IR 4.0 adoption are discussed in Table 3:

Table 3: Survey result on challenges to implement IR 4.0 programs.

S.NO	COUNTRY	Major Challenges
1.	Bhutan	Lack of appropriate teaching tools and equipment, lack of understanding on IR4.0 in general among the TVET Professionals and in-adequate support from the industries are some of the major challenges in implementation of TVET program with IR4.0 requirement.
2.	Fiji	• Expertise • Development of policies and laws • Finance • Sponsorship
3.	Malaysia	• Lack of educators • Lack of 4IR knowledge • Different perspective on 4IR among people
4.	Nepal	Infrastructure and present industry challenges
5.	Pakistan	• Presently the society is at IR 2.0 level and IR 4.0 is not implemented in sectors of economy except one or two sectors i.e. Textiles & Logistics • Non availability of Teachers • High Cost of relevant material of teaching • Needs higher level of formal education as minimum qualification for students • No market demand • Lack of funding

Suggestions to Implement Similar Programs in Other Countries

Different researches revealed that millions of people are unemployed or underemployed in the region, while employers have jobs that cannot be filled. Thus, the suggestions to capitalize on the benefits of the shifting industrial trend and prepare the youth in excelling in it is necessary. Table 4 below presents the suggestions of the member countries in improving their own IR 4.0 programs.

Table 4: Survey result on suggestions to implement IR 4.0 programs.

S.NO	COUNTRY	SUGGESTIONS
1.	Bhutan	It is imperative to build capacity of TVET Professionals before implementation of the program related to IR4.0, foster strong linkage and partnership with industries and diversify programs based on the country's economic need.
2.	Fiji	N/A
3.	Malaysia	Propose an IT program which lead to business makers
4.	Nepal	Try to make country-specific program by understanding the context of the country
5.	Pakistan	Each country may design its own programs according to its unique circumstances and level of industrialization.
	SECONDARY DATA	
	Deloitte Report (2018)	• Align stakeholders' objectives and approaches • Engage in public policy • Develop promising talent strategies

Implication of the Findings

The research study shows that CPSC member countries through TVET providers have to further strengthen their commitment towards IR 4.0 and produce future IR 4.0 skilled workers that will meet the challenges of big data technology, virtual workplaces etc. Thus policy on IR 4.0 in the TVET sector is very important to address the present day industry requirements. Implications for TVET providers are develop policy on IR 4.0, innovative curricula, upskilling, re-skilling of TVET teachers, model institutions for technological innovation and advancement, and an essential aspect of teaching's cultural toolkit in the twenty first century, affording new and transformative models of development. The implication also poses a great challenge to stakeholders, stakeholders in TVET program should be made to support TVET institutions with latest technologies such as Big Data technology through provision of physical facilities and material resources such as augmented reality labs, and 3D printing tools should be provided in TVET institutions.

Conclusions

In a nutshell, IR 4.0 is a unique opportunity for TVET providers and has to be welcomed to transform the whole TVET system while developing innovative policies and framework on IR 4.0. The majority of CPSC member countries do not have policies and legal provisions on

developing IR 4.0 except Malaysia, Thailand and Pakistan. There was enough evidence to conclude that most of the CPSC countries are offering IR 4.0 related programs to support the industry. The research study also identified that TVET support is tremendous by offering IR 4.0 related-programs to complement the industry needs. It is further concluded that the TVET system faces a number of challenges to implement IR 4.0 related TVET programs such as lack of expertise, infrastructure and appropriate teaching and learning tools. The research also concluded and suggested that CPSC member countries have to invest strategically in development of new training programs and development of new infrastructure.

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Status of Entrepreneurship Education in TVET in CPSC Member Countries

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Abstract

This research paper attempts to provide information on entrepreneurial education which is one of the major components of the TVET system. The study was conducted in 16 CPSC member countries in Asia Pacific, however only six of them provided information on the questionnaire provided by CPSC. A descriptive survey research design was used where both quantitative and qualitative methodologies were used. Data collection methods included closed ended questionnaires. In order to analyze the qualitative data, the content analysis method is used to analyze the responses received. The findings of the study showed that 90% of CPSC member countries have legal policy and framework documents to address the needs of entrepreneurship education. It was found that 80% of CPSC member countries have directly and indirectly addressed the entrepreneurial components in their curricula or competency standards. It was identified that all countries have realized the importance and need of entrepreneurship education to build the economy of the nation by producing entrepreneurs for small and mid-level enterprises.

Keywords: Entrepreneurship, Entrepreneurs, Education, Training, Technopreneurship

Introduction

The entrepreneurship education of TVET has become a powerful tool for creating jobs and improving economic power in the labor market and economy as a whole. Moreover, with the advent of the fourth industrial revolution, a variety of competencies such as creativity, innovation, and agility are required for start-ups. Therefore, most TVET institutions currently provide entrepreneurial training programs with the belief that the importance of entrepreneurship and the knowledge and skills needed to become an entrepreneur can be taught, and the proportion of policy support toward entrepreneurship education has been increasing in many countries around the world. The entrepreneur is identified as the agent who decides to start a new business from the breakdown of a paradigm by inserting a new product or service in the market (O'Connor, 2013). In addition, interest and investment in entrepreneurship education are increasing in all TVET schools to graduate schools in order to increase entrepreneurial thinking. Entrepreneurship education in TVET plays an important role in an uncertain environment because it can develop the insights needed to discover and create opportunities for entrepreneurs and gain the ability to successfully start and manage their own businesses. Therefore, the TVET institutes have emphasized the necessity of systematic entrepreneurship education and played a role in conducting

professional entrepreneurship education. Many institutions are also actively pursuing a variety of educational developments as part of their broader strategy to improve the quality of entrepreneurial courses and programs and to encourage student education and learning. Moreover, they offer many entrepreneurship related courses and programs in purpose of providing students with motivation and confidence in entrepreneurship and a role for social contribution through entrepreneurship.

TVET in the Asia Pacific region plays an instrumental role to produce semi-skilled and skilled human resources to fill the gaps of skilled human resources in the small and medium enterprises and businesses. The focus of 16 member countries of CPSC (Bangladesh, Bhutan, Fiji, India, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, and Thailand) is to provide quality technical education, develop national qualification standards, enhance learning, capacitate instructors and managers and formulate TVET policy. Asia pacific countries are geared towards updating and modernizing the TVET system in order to respond to the needs of industry and labor markets to remain competitive.

In this study, the effectiveness of entrepreneurship education is defined as the degree of entrepreneurial curriculum standards, course duration, wastages and level of proficiency. This study analyzes characteristics of entrepreneurship curriculum and educational programs offered by entrepreneurship education providers in TVET through the structured questionnaire. The results of this study will provide practical guidelines for the TVET officials and policy makers to evaluate and improve entrepreneurial education programs.

Statement of the Problem

Colombo Plan Staff College, Manila Philippines was established in 1973 as the response of Singapore Colloquium in May 1969 to equip Technical and Vocational Education and Training (TVET) personnel in the member countries with up-to-date knowledge and skills in various areas of interest. CPSC initiates this research mainly to find out the status of entrepreneurship education in TVET in the CPSC member countries namely entrepreneurship components in curriculum, duration, weightage given and implementation status. The research results will be useful to member countries as well as other stakeholders to know the entrepreneurship status and further improve their entrepreneurship education in TVET. CPSC encourages additional research efforts to other new research agenda or theories specific to the Asia Pacific and consequently provide insights different from the American or European perspectives. Essentially, this proposed undertaking shall advance our understanding on entrepreneurship education in TVET.

Objective of the Study

The study aims to achieve the following:

- Identify integration of entrepreneurial components in the curriculum by the CPSC member countries

- Identify duration and weightages provided to the entrepreneurship components in the curriculum

- Find out up to which level of proficiency (certificate, diploma, degree) of entrepreneurship education is available

- What are the challenges in implementation of entrepreneurship education?

Research Questions

The following questions will be used to fulfill the objectives:

- Is there a national policy/act to support entrepreneurship education in TVET?

- What are the TVET programs related to entrepreneurship education?

- How is the composition and structure of curricula for entrepreneurial competencies?

- What are the major challenges to implement programs on entrepreneurship education?

- What are the suggestions would you like to give to implement similar programs in other countries?

- Which proficiency level of education (certificate, diploma, degree) is addressed by entrepreneurship education?

Review of Related Literature

The literature review was conducted to know in-depth information of entrepreneurship education through on-line portals such as Google, research papers, and other documents. The findings of the literature reviews are provided below:

Entrepreneurship Education in Bangladesh

Following are the course structure of entrepreneurship education in the TVET in Bangladesh (Bangladesh Technical Education Board, 2020).

1.	Entrepreneurship in Diploma in Engineering Courses:

Name of The subject: Entrepreneurship and Innovation taught at 7th Semester.

Contact hour: 2 contact hours per week. Total 32 contact hours (2 Credit).

Nature of delivery: Theoretical classes with some assignments (Project work)

Assessment system: Theory- continuous assessment (40 marks) and final assessment (60 marks) totaling 100 marks

Course structure:

- Understand the concept of entrepreneurship & entrepreneur.

- Understand the concept of environment for entrepreneurship.

- Understand the sources of venture ideas in Bangladesh.

- Understand the project selection.

- Understand business planning.

- Understand the insurance and premium.

- Understand the concept of self-employment.

- Understand the MDG & SDG.

- Understand the concept of entrepreneurship in the theories of economic growth.

2. Entrepreneurship in Certificate Courses: Higher Secondary Certificate in Vocational (HSC VOC): Name of the Subject: Career Guidance and Entrepreneurship taught at class twelve. Three classes (Contact hour) per week. Theoretical classes with some assignments (Project work)

3. Entrepreneurship in Certificate Courses: Higher Secondary Certificate in Business Management (HSC BM): Name of the Subject: Entrepreneurship Development included as a specialized subject student can choose as additional subject taught at class eleven and twelve. Two classes (Contact hour) per week. Theoretical classes with some assignments (Project work)

4. Entrepreneurship in Certificate Courses: Secondary School Certificate in Vocational (SSC VOC): Name of the Subject: Self Employment and Entrepreneurship taught at class ten. Two classes (contact hour) per week. Theoretical classes with some assignments (Project work)

Entrepreneurship Education in Nepal

Council for Technical Education and Vocational Training (CTEVT) developed a curriculum on Junior Diary Technicians which is for 1710 hours and divided into four modules. The third module is Entrepreneurship Development, which consist of following skills (CTEVT, 2020):

Generic Skills

- Entrepreneurship Skills

- Sales and Marketing

- Accounting and Presentation of Skills

- The entrepreneurship module is for 130 hours and the full mark is 100.

Similarly, CTEVT has developed 390 hours short-term training for example in Dairy Farm Worker has entrepreneurship development course for 56 hours (22 hours for theory and 34 hours for practical) and full mark is 60 (12 for theory and 48 for practical).

Also, CTEVT develop Diploma level program for 3 years for example in Automobile Engineering has entrepreneurship development course for 75 hours and full mark is 100.

Entrepreneurship Education in the Philippines

Technical Education and Skills Development Authority (TESDA) through the National Competency Standards included the entrepreneurial competencies in L1, L2, L3, L4, and L5 (TESDA, 2020):

LI- Competency: Adopt entrepreneurial mind-set in workplace

- Determine entrepreneurial mindset

- Identify entrepreneurial practices

L2- Competency: Practice entrepreneurial skills in the workplace

- Apply entrepreneurial workplace best practices

- Communicate entrepreneurial workplace best practices

- Implement cost effective operations

L3- Competency: Facilitate entrepreneurial skills for micro-small-medium enterprises (MSMEs)

- Develop and maintain micro-small medium enterprise (MSMEs) skills in the organization

- Establish and maintain client-base/ market

- Apply budgeting and financial management skills

L4- Competency: Sustain entrepreneurial skills

- Enhance one's business skills

- Manage entrepreneurial practices

- Expand markets and clientele

L5- Competency: Develop and sustain a high-performing enterprise

- Shape enterprise directions

- Determine demands for new products

- Expand clientele and product lines

- Establish high performing teams

Research Methodology

This research is being conducted by using the survey questionnaires to look closely at the entrepreneurship education, namely curriculum components, and proficiency level of education in the sixteen member countries of CPSC. In the context of this study, entrepreneurship curriculum were assessed and other details pertaining to entrepreneurship education were looked after. The study was based on primary data collected through a survey by using a question guide in which the respondents will fill the answers based on their experience. The respective vocational public and private universities, training institutes, schools and colleges offering entrepreneurship course(s) were selected as the primary respondents of the survey. However, secondary data was collected from on-line materials like previously conducted research, studies, and available facts and figures.

Population and Sampling

Qualitative approach was used in this study, and a questionnaire was a primary instrument to collect data from the respondents. The questionnaires were distributed to the relevant schools, colleges and institutes in the sixteen member countries to obtain data through the liaison officers of CPSC stationed in the sixteen countries. A purposive sampling was employed, with pre-identified users from CPSC's networks. At least one response per member country was targeted.

Findings of the Research

The research findings are presented below in tables. The responses of seven research questions are presented as survey findings and secondary data findings. Some of the data are not explicitly mentioned and still in some cases clarifications from source are required.

Policies, acts and legal provisions on development of curriculum or program for entrepreneurship education in TVET

In order to determine the existing policies and legal provisions of TVET institutions towards entrepreneurship education data received from member countries is presented in the (Table 1) below:

Table 1: Summarized data on legal provisions of entrepreneurship education in member countries

Countries	Policy	Act	Regulations	Framework	NVQF
Bhutan	TVET, Economy, Cottage & Small Medium Industry				
Fiji			Higher Education, Higher Education Qualification, Higher Education Qualifications (Amendment)	National Curriculum	
Malaysia	Higher Education Entrepreneurship Development				
	TVET	TVET			
Nepal					
Pakistan					NVQF
Singapore	NA				

The findings have indicated that through the education and entrepreneurship act/policy CPSC member countries have addressed the entrepreneurship education components in their education and TVET system as per the demand of self-employment and technological advancement. However, countries like Malaysia have directly addressed entrepreneurship education through the policy, whereas other countries have addressed it by act, regulations, and frameworks. Composition and structure of curricula for entrepreneurial competencies

Table 2: Data on legal provisions of entrepreneurship education in member countries

Country	Findings
Bhutan	Vocational Education and Training (VET) Policy 2006, Guidelines for TVET Curriculum development, National Competency Standards, Economic Development Policy 2016. Cottage Small and Medium Industry Policy 2018.
Fiji	Higher Education Act 2008 Higher Education Regulation 2009 Higher Education (Qualifications) Regulations 2010 Higher Education (Qualifications) (Amendment) Regulations 2013 Higher Education (Amendment) 2017 The Fiji Islands National Curriculum Framework 2007 Policy on Technical College of Fiji A National Apprenticeship Review Taskforce National Apprenticeship Training Scheme National Training & Productivity Centre (NTPC)
Malaysia	Malaysia Higher Education Entrepreneurship Development Policy (2010)
Nepal	CTEVT Act, 1989 TVET Policy, 2012 TVET Act (in-process of finalization)
Pakistan	National Vocational Qualification Framework 2017
Singapore	n/a
	Secondary Data
Philippines	Youth Entrepreneurship Act (2015)
Thailand	National Education Act of B.E. 2542 (1999), Social Enterprise Promotion Act (2019)
Mongolia	n/a
India	"Make in India" Policy (2014), "Ministry Formation for Skill Development and Entrepreneurship-2014", "National Policy for Skill Development and Entrepreneurship" (2015)

The CPSC member countries have incorporated the entrepreneurship component in their TVET curriculum through the national competency standards development, curriculum development, and developing courses on entrepreneurship. However, the entrepreneurship content and duration differ from one country to another.

Table 3: Data on composition and structure of curricula for entrepreneurial competencies

Country	Findings
Bhutan	Offering a Module course in Entrepreneurship (220 hours) for Technical Training Institutes and Institutes (TTIS) for Zorig Chusum (IZC). Cefe Methodology used for training entrepreneurship in TTIs and IZCs.
Fiji	• TVET aims to facilitate sustainable economic and social development by providing students with the knowledge, values and attitudes necessary to perform technological skills in both the formal and informal sectors of the economy. Students with disabilities will benefit from TVET and it can help them to lead regular lives.

Country	Findings
	• TVET is designed to deliver a holistic, enhanced, student-centered approach to learning by applying the most effective, flexible and appropriate teaching and learning modes and technologies. It aims to encourage independence, innovation, creativity and problem-solving skills through flexible approaches to learning, and thus prepare students for the future. • TVET seeks to promote a sound work ethic and to raise learner-awareness of the importance and dignity of technical and vocational education in both the social and economic development of the nation. It offers a pathway to higher education, and provides students and early school leavers with transferable skills needed for employment in a wide range of employment opportunities. • Currently, in Fiji there is no proper structure of curricula of entrepreneurial competencies.
Malaysia	From the Diploma in Tourism Management Program structure, probably only 16% implemented in program courses.
Nepal	Technical School Leaving Certificates (TSLC) - 156 hours and 78 Hours TSLC in Entrepreneurship Development- 5 months including 3 months on the job training (OJT) Short Term Skill Development Courses- Theory: 18 hrs, Practical: 22 hrs Total: 40 hrs
Pakistan	NAVTTC is in the process of converting its curricula for almost all trades into Competency Based Training and Assessment (CBT&A) systems. The competencies for Entrepreneurial skills are made part of all such curricula of all levels.
Singapore	The Diploma Plus Certificate in Business Innovation and Entrepreneurship offered by the Republic Polytechnic is an example of an entrepreneurship education program in TVET. The course allows students to generate their own business ideas and develop user-centric business solutions through the problem-based learning approach. The program also provides opportunities for students to participate in local and international business plan competitions and incubate their start-up ideas at the Enterprise Services Centre on campus.

TVET Programs Related to Entrepreneurship Education

The CPSC member countries have launched different programs to address the need of entrepreneurship education for the youths of their countries. The intention and aim of the programs are the same, only the names are different. Some programs are technology based and aimed to produce technopreneurs, which is the demand of the 21st century.

Table 4: Data on types of TVET programs related to entrepreneurship education

Country	Findings
	Business Incubation Units (BIU) set up in few TTIs and IZCs. Start-up programs conducted in two TTIs. Have a plan to establish Start-up and Fablabs in all TTIs & IZCs.
Malaysia	There is no linkages or connection of the Entrepreneurship education to the TVET program in Fiji

Country	Findings
Nepal	At PTS, entrepreneurship education is particularly related to 'Entrepreneurship' courses and other courses embedded in the subtopics.
	PTS also provides an entrepreneurship incubator to help students and alumni in pursue care
Pakistan	Diploma in Entrepreneur Development
Singapore	As discussed in (2) above, entrepreneurship competencies would be part of all curricula prepared on the CBT & A system. Moreover, a separate diploma for entrepreneurship (level 5) is also prepared for interested students.
Secondary Data	
Philippines	The Batangas State University Philippines Program- Center for Technopreneurship and Innovation (CTI)
Mongolia	Regional Entrepreneurship Acceleration Program (REAP), UNDP launched Activated 2030 Program

Proficiency Levels of Education (Certificate, Diploma, Degree) Addressed by Entrepreneurship Education

As per the data received from six member countries (Table 5) shows that they have provided entrepreneurship education in certificate and diploma level. From secondary data, it can be concluded that the CPSC member countries are providing entrepreneurship education in almost all levels of education from certificate to masters' degrees. However, it was not explicitly mentioned in literature reviews that countries like Mongolia, Fiji, and Papua New Guinea are implementing entrepreneurship education at all levels.

Table 5: Summarized data on proficiency levels of education (certificate, diploma, degree) is addresses by the entrepreneurship education

Countries	Certificate	Diploma
Bhutan	•	
Fiji		•
Malaysia		•
Nepal		•
Pakistan	•	•
Singapore		•

Table 6: Data on proficiency levels of education (certificate, diploma, degree) is addresses by the entrepreneurship education

Country	Findings
Bhutan	Entrepreneur Module completion certificate
Fiji	There is no level of certification and recognition of entrepreneurship education in Fiji
Malaysia	At PTS, the entrepreneurship education is addressed in Diploma in Tourism Management specifically in one course. While other courses are implemented in one of the subtopics of the course itself. Students learned entrepreneurship skills starting from 2nd semester until 5th semester.

Country	Findings
Nepal	Diploma in Entrepreneurship Development
Pakistan	NAVTTC is in the process of converting its curricula for almost all trades into Competency Based Training and Assessment (CBT&A) systems. The competencies for Entrepreneurial skills are made part of all such curricula of all levels.
Singapore	Diploma Plus Certificate in Business Innovation and Entrepreneurship
Secondary Data	
Philippines	Diploma, Bachelor, Masters, BBA, in Entrepreneurship and MBA in Technology and Entrepreneurship
Thailand	Diploma, Bachelor, and Masters in Entrepreneurship
India	Certificate, Bachelor, Masters, BBA, MBA in Entrepreneurship
Bangladesh	Certificate, Diploma and Under-Graduate and Postgraduate Programs in Entrepreneurship

Major Challenges to Implement Programs on Entrepreneurship Education

The major challenges mentioned to implement the entrepreneurship education are as follows:

- Finding a trained and dedicated trainer
- Not adequate training materials and equipment
- Not relevant and appropriate research conducted in entrepreneurship
- Lack of experts in curriculum revision
- Not enough funds from government side
- Need of additional incentives for the trainers to manage the programs
- No business incubation centers available
- Not supportive government policies and regulations

Table 7: Major challenges to implement programs on entrepreneurship education

Country	Findings
Bhutan	Not having a dedicated trainer for the Module course. Lack of human capacity and training materials. Need of R&D. Limited excess to finance. Solution: As an interim measure each TTIS & IZCs have the focal trained trainer in entrepreneurship education
Fiji	Currently, there is no inclusion of Entrepreneurship education in Fiji's curriculum Technology and finance Expertise to develop the right curriculum

Country	Findings
Malaysia	One of the major challenges is money capital or foundation. PTS is a government's institution, there are strict rules and procedures to obey to get the money/fund. Others like people who manage entrepreneurship education usually have many other jobs/things to do at the workplace. In other words, lack of time. Some staff are not desired to handle the programs. The organization needs to find staff that are interested and probably be paid for the job or other incentives given.
Nepal	No business incubation center
Pakistan	There are a number of challenges for entrepreneurship education from market conditions lacking attraction for start of new business, non-supportive government's regulations to non availability of trainers.
Singapore	*unable to advise

Suggestions on implementing entrepreneurship programs

The suggestions provided by the CPSC member countries to implement the entrepreneurship programs are as follows:

- The course structure should be comprehensive and have all the competency standards

- Need to develop human resources to manage the programs and some extra incentives need to be provided to the trainers

- Incorporation of entrepreneurial components in all TVET curriculum and implementation of entrepreneurship education in all levels

- Need to conduct awareness campaigns to raise awareness of the programs to the youths

- Governments need to give priority to the entrepreneurship education and allocate enough funds to implement the programs

- Need freedom to implement entrepreneurship programs by the training center without any top management obstruction

- The programs for entrepreneurial skills must be designed according to unique situation of each individual country

Table 8: Suggestions received to implement similar program in other countries

Country	Findings
Bhutan	Have a full fledged course and have a dedicated trainer. To have Entrepreneurship education, BIU, R&D in all TVET institutes
Fiji	Access to right for information Inclusion of Entrepreneurship education in Fiji's curriculum and introduction in levels of learning
Malaysia	Need more money, capital / foundation. Need to open to whom that interested and willingly to manage and involve in the programmes Give freedom of choices particular what kind of business/product/service to be in the entrepreneurship programs without too many decisions made from top management.
Nepal	No suggestions
Pakistan	The programs for entrepreneurial skills must be designed according to the unique situation of each individual country.
Singapore	*unable to advise

Employment Related Data

The CPSC member countries could not provide the employment related data precisely due to different reasons and maybe the system was not established to track the employment data, namely self-employment data. Find the employment related data in (Table 9):

Country	Total Annual Graduation Rate from TVET Institutions (2016-2017, 2017-2018)	Employment Rate among TVET Graduates	Self-Employment Rate
Bhutan	620 graduated in 16/17, 972 graduated on 17/18.	80 to 85 % annually	4 to 5 %
Fiji	n/a	n/a	n/a
Malaysia	n/a	n/a	n/a
Nepal	n/a	n/a	n/a
Pakistan	300,000 annually	20%	2%
Singapore	93%	*refer to Annex below	n/a

Conclusions

The research shows that they have been providing entrepreneurship education in certificate and diploma level. From secondary data, it can be concluded that the CPSC member countries are providing entrepreneurship education in almost all levels of education from certificate to masters' degrees. However, it was not explicitly mentioned in literature reviews that countries like Mongolia, Fiji, and Papua New Guinea are implementing entrepreneurship education at all levels.

The findings have indicated that through the education and entrepreneurship act/policy CPSC member countries have addressed the entrepreneurship education components in their education and TVET system. However, countries like Malaysia have directly addressed entrepreneurship education through the policy, whereas other countries have addressed it by act, regulations, and frameworks.

The CPSC member countries have incorporated the entrepreneurship component in their TVET curriculum through the national competency standards development, curriculum development, and developing courses on entrepreneurship. However, the entrepreneurship content and duration differ from one country to another.

The CPSC member countries have launched different programs to address the need of entrepreneurship education for the youths of their countries. The intention and aim of the programs are the same, only the names are different. Some programs are technology based and aimed to produce technopreneurs, which is the demand of the 21st century.

Recommendations

The following are recommendations for the further improvements of the entrepreneurship education in the CPSC member countries:

- The entrepreneurship course structure should be consistent in all levels of education, which will enhance the cross-border employment opportunities and globalization of employment.

- As per the country context, need to develop human resources to manage the entrepreneurship programs and some extra incentives need to be provided to the trainers

- The government should tke initiative on incorporation of entrepreneurial components in all TVET curriculum and implementation of entrepreneurship education in all levels

- The government should conduct awareness campaigns to raise awareness of the programs to the youths and stress the importance of self-employment

- Governments need to give priority to the entrepreneurship education and allocate enough funds to implement the programs

- While developing national competency standards and revising curriculum, the country context like what indigenous resources available should be taken into consideration.

- Government should capacitate training center managers & trainers and timely update on new technology and innovation advancement.

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Fabricating Solar Power Generating Apparatus

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Abstract

This research examines the functionality and efficiency of using the Solar Power Generating Apparatus and determines the benefits of using the project compared to commercial solar power lighting and charging systems. The study is important because it addressed the problems of indoor and outdoor lighting and capability of charging mobile phones. With the existing system, remote areas without electrical connection could be safely lighted at low cost instead of using candles. Data for this study were gathered through testing its functionality, and efficiency. The findings suggest that the use of this project is more economical than using candle light and very useful in rural areas with no electricity and in urban areas during power interruption. Main conclusions from the study are: The project is sustainable since it is low-cost, environment-friendly since it supports green technology and produces a cleaner alternative source of power for a healthy work environment. The main recommendation from this report is to use a bigger battery and higher wattage PV Module (Solar Panel) to increase the capacity of the project. It can be easily assembled by hobbyists and students taking courses under the Electrical and Electronics sector to develop their innovativeness.

Keywords: Solar Power, solar lighting system, solar power apparatus

Introduction

Climate change and global warming resulting from widespread disasters and calamities of different forms that result in power crisis is a worldwide problem. One of the major causes of these problems are pollutants caused by gas emission from electric power plants and other air contaminants affecting the greenhouse effect of the ozone layer. The use of renewable energy is one of the alternative sources of energy and solutions to minimize gas emission (Arruda et al, 2010). Utilization of renewable energy such as wind and sunlight promotes green technology and produces green jobs for a healthy environment (Best, 2008). To support the utilization of renewable energy, the Philippine government enacted the "Renewable Energy Act of 2008" or RA 9513, an act promoting the development, utilization and commercialization of renewable energy resources and for other purposes.

One of the most affected services during calamities is electricity and communication. Immediate restoration of lighting and communication is necessary but restoring such

services is very difficult due to damaged infrastructures (Jacobson, 2013). This project was conceptualized to provide power for mobile phone and emergency lighting to speed up relief operation and reduce risk of accident which may result in a greater loss of properties and life. This is also to provide power during long dry spells where occasional brown out happens due to scarcity of water resources and environmental problems caused by hydro-electric plants (Commerford, 2011). This project is also suitable for indoor and outdoor use or and street lighting (Bollinger, 2007). It is portable for use during camping and other outdoor activities. It is very economical, and very safe to use compared to a candle light and kerosene lamp which is unsafe and poor quality of light (Adkins, 2009). The project has multiple functions such as: mobile phone charger, power bank and power source for LED light.

Using LED light instead of candle generates great savings. If one regular size candle will cost P5.00 pesos and in one night will consume at least three candles. If three candles will be used in one night, it will consume 1,095 pieces of candles in a year which will cost up to P5,575.00 pesos. The project cost is only P1,600.00 pesos with a battery that will last for two to three years and a panel that may last up to 20 years. This estimate will generate savings of P3,975.00 in one year for a better quality of light and safer than using a candle light.

The power bank is capable of powering LED light and charging a mobile phone and a battery bank. Materials used advocates 3R's, (Reuse, Recycle, Reduce) of the Philippine Integrated Waste Management to protect the environment and bring productivity to the people and promote a safe environment. Methods used for the project are designing the circuit and assembling the proto type and testing its functionality (Rajvanshi, 2006).

Main Focus of the Project

There is a need to promote green technology due to climate change, global warming and widespread calamities resulting in a power crisis and widespread phenomenon. The project is focused on designing, fabricating and testing the functionality and to determine its advantages compared to other types of lighting systems. Is suitable for indoor and outdoor used, portable and handy for camping specifically for lighting and mobile phone charging.

General Objective:

> To design and fabricate a solar power generating apparatus.

Specific Objectives:

- To design emergency lighting and charging systems.

- To fabricate project prototype

- To test functionality of the project

Problems Addressed:

- Unsafe use of candle light and kerosene lamp in the household

- Absence of electricity to energize lighting and charging systems in remote areas.

- Low level of public awareness regarding the use of renewable energy for environmental protection.

Methodology

The weather in the Philippines and neighboring countries where sunlight is abundant in most seasons of the year is very suitable for this project. Voltage is generated through the Photovoltaic Cell otherwise known as solar panel by the presence of sunlight. Direct current electricity is then stored to a battery bank. A solar or sun's energy is the most accessible and most abundant among the renewable sources of energy (wind, hydro, etc.). Solar energy can be converted into electricity through the use of solar or photovoltaic cells. This characteristic of a solar or photovoltaic (PV) system is very suitable for lighting and other purposes (Cotar, Filic, 2012). The researcher comes up to design a portable multi-purpose solar power system.

The project consisted of a solar panel, charge controller, battery (serve as power bank) and LED bulb (DC load). Refer to block diagram in Figure 1
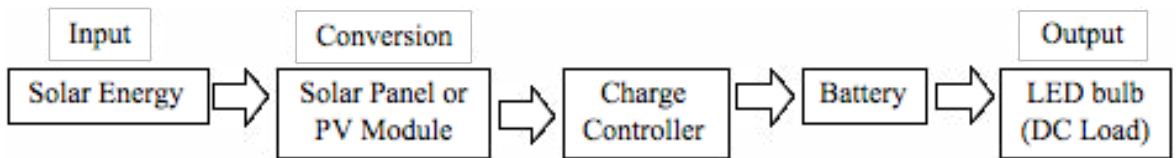

Figure. 1: Block Diagram

The solar panel or PV module converts solar energy into DC electricity. The project used two pieces of solar panel rated 5.5 volts and 1.3 watts, connected in a series. The solar panel information is shown in Figure 2a. The red and black wires are the positive and negative terminals of the panel. The IN5817 diode is connected to the positive terminal to prevent discharging during the absence of sunlight (Figure 2b). Each end of the wires is connected with a red and black terminal. The two solar panels with a dimension of 15.5cm x 10cm were mounted on a metal frame (recycled) that is 25 - 30 degrees inclined (Figure 2c).

Figure 2a:
Solar specifications

Figure 2b:
Solar Panel (Back)

Figure 2c:
Solar Panel (Front)

Charge Controller and Night Switch

The charge controller and night switch are integrated in one circuit. The charge controller regulated the output voltage up to 8.4 volts and the current from the solar panel going to the battery. The charge controller automatically charges the four 3.6 batteries connected in series and parallel combination to produce at least 7.4V, lithium battery. The night switch automatically turns on the LED during night time and turns off the light during daytime. The LED light can be powered separately using the power bank when a portable light is necessary. It can also be manually switched on and off when the power bank is used separately. The schematic diagram of the night switch is shown on Figure 3a.
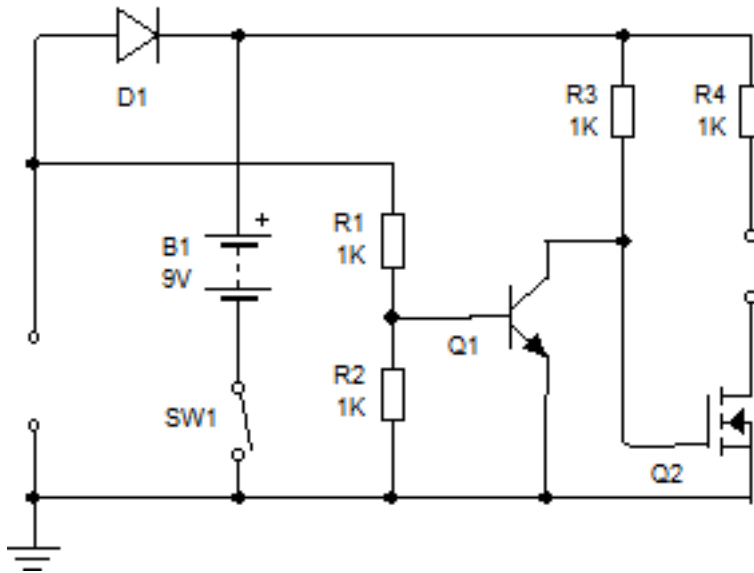

Figure 3a: Schematic diagram of Charge Controller and Night Switch by R.Q. Macolor, Solar Night Light (2013)

Figure 3b: PCB layout and parts placement by R.Q. Macolor, Solar Night Light, 2013

Table 1: Charge controller and night switch components

Quantity	Description	Value
1	Resistor	3.3Ω, 2W
1	Resistor	10 KΩ, 0.25W
2	Resistor	1 KΩ, 0.25W
1	Diode	IN5817
1	Transistor	IRF510
1	Transistor	S9014
1	Switch	3P Switch

Battery

The battery stores electrical energy for future consumption. The battery in this project is a 2200mA rechargeable lithium battery (see Fig. 3.4). Battery specifications are shown on Table 2.

Figure 4: lithium battery

Table. 2: Battery Specifications

Battery Type	Lithium Ion
Nominal Voltage	3.6V
Charging Voltage	4.20V

Light Emitting Diode (LED)

The lights used in this project are four 1-watt LED lamps connected in a complex circuit (series and parallel) then mounted on a LED bulb casing (recycled busted LED Bulb) (see Figure 5a, Figure 5b and Figure 5c). Red and black wires are connected to the positive and negative terminal of the bulb respectively. The LED lamp complete specifications are shown in Table 3.
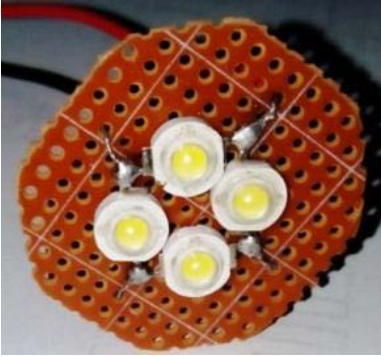
| Figure 5a: LED assembl | Figure 5b: LED Casing | Figure 5c: LED bulb |

Table. 2: Battery Specifications

Power	1W
Operating Voltage	3.2V to 6V
Max Current	350mA
Luminous flux	90LM to 100LM
Color Temperature	3500K to 5500K
Working Temperature	0°C to 40°C
Storage Temperature	-20°C to 60°C

Assembling Procedures

To fabricate the charge controller, the researcher designed a Printed Circuit Board (PCB) and prepared the lay-out of the schematic diagram. He etched it with environment friendly etching solutions using the PCB layout and parts placement designed by R.Q. Macolor, Solar Night Light (As cited in Dienst, 2013). The PCB layout and parts placement were shown in Figure 3b. No drilling was required on the PCB. The components were positioned directly on the PCB.

Fig. 3.6: Project Prototype

The four subsystems were all connected with respect to the schematic diagram shown on Figure 3a and Parts Placement illustrated on Figure 3b. Red wires represented positive and black wire represented negative charges. To avoid the malfunction of the project during operation, the proper materials, procedures and connection were followed. To prevent damage to the system, the polarity of the components were not interchanged (Hubilla, 2017, unpublished).

Results and Discussions

After assembling the prototype, a functionality test was performed to determine the charging time and discharging time of the project. The test was performed by exposing the prototype under the sun at normal sunlight condition (Figure 7a), partly sunny day, (Figure 7b), and cloudy or rainy day, (Figure 7c).

The graphs above are the gathered data during testing. The researcher also tested the charging under normal sunlight conditions, cloudy day and rainy day. See table 4 for the charging summary.

The prototype discharging time was also tested. The LED bulb was put into operation to determine how long the fully-charged battery can keep it lighting. The researcher found out that the fully-charged battery is sufficient to keep the lights on for 6-8 hours. Based on the test conducted, the discharged battery takes about 10 hours (7:00am to 5:00pm) to be fully-charged on a sunny day. The charging starts when the solar panel output is within or above the charging voltage of the battery (4.2V).
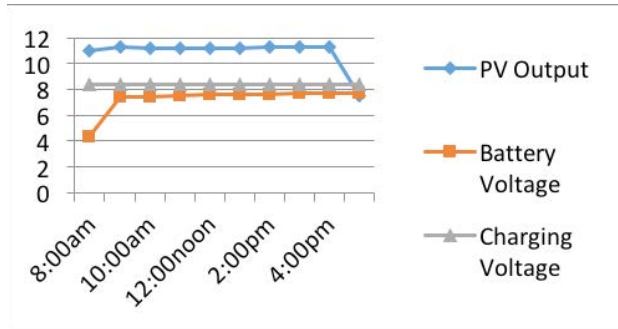

Figure 7a: PV voltage and Battery voltage levels during a normal sunlight condition. The battery charge on a sunny day can light the led bulb efficiently for up to 6-8 hours.
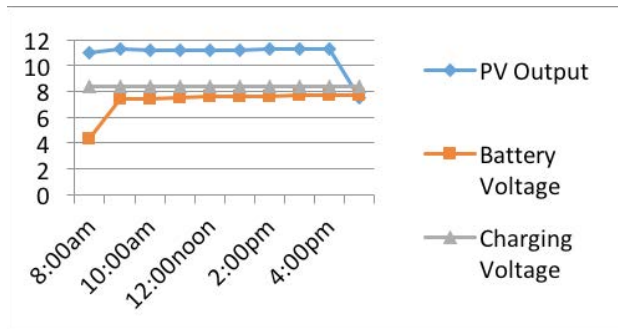

Figure 7b : PV voltage and Battery voltage levels during a partly sunny day.
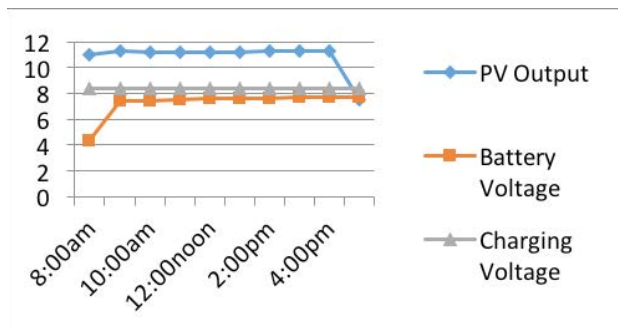The battery charge on a sunny day can light the led bulb efficiently for up to 3 hours.

Figure 7c: PV voltage and Battery voltage levels during rainy / cloudy day.

Table. 4: Proto-type Charging Summary

Weather Condition:	Battery Charge Level After Test:
Sunny	Fully Charged
Partly Sunny Day	70% Charged
Cloudy or Rainy Day	Battery was not able to charge

On a cloudy day the battery was only partially charged because it requires longer charging and on a rainy day the battery was not charged for the charging voltage was not attained.

The result showed that the prototype is much efficient and effective on sunny days. It was observed that the discharging time of the battery was longer compared to the charging time. This is due to low power consumption of the LED bulb used in the prototype. The power bank used to charge a mobile phone (Lenovo, Model: A526), will only take 1.5 hr. to 2 hrs. to fully charge. The power bank is only good for one charging cycle and it must be fully charged again for next use.

Conclusions

The Solar Power Generating Apparatus does not aim to replace the existing outdoor or indoor lighting. The design is suited for emergency lighting and charging systems. Based on the tests results, it is capable of providing an alternative source of lighting and charging cellular phones during power interruptions. The storage battery pack will also serve as a power bank, capable of charging ideal cellular phones in one charging cycle. This project is safer to use than using a candle light and is highly recommended for lighting on areas where electricity is unstable and in remote places where provision of electricity is difficult.

The prototype is best suited for indoor and outdoor use and it is sustainable and economical since it is low-cost. It is also environmentally-friendly since it supports green technology and produces a cleaner alternative source of power for smaller gadgets. It is also portable and easy to use and it supports green technology while maintaining a healthy living environment.

Recommendations

The battery should be fully-charged before use. To do this, the solar panel must be placed in an open area with exposure to direct sunlight. Also, it is important to ensure that the solar panel has no obstruction on exposure to direct sunlight.

The project can be used either indoors or outdoors. If placed indoors, the controller and the bulb must be fixed inside the house with the shortest possible distance from the solar panel. If placed outdoors, the controller and the bulb must be in an area where water cannot penetrate the prototype. The prototype can be manually or automatically operated. It automatically turns on the LED bulb during night time provided that the main switch is turned on. The prototype also switches off automatically during day time. The prototype is only applicable for 7.2V DC lighting.

A cellular phone can be best charged during daytime under sunny conditions or it can be charged directly from the battery bank. It is recommended to use the prototype on automatic switching to prevent damage caused by frequent turning on and off the switch.

This project will be beneficial for households at night as their light source is being secured. To improve the project further, it is recommended to add a charge indicator as well as an overcharge and over-discharge controller. It is also recommended to use a bigger battery and solar panel to increase capacity of the project. The power source can be increased to 12V provided that additional LED light will be used.

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List of Acronyms

ADB	Asian Development Bank
ASSOCHAM	Associated Chambers of Commerce and Industry
BBA	Bachelor of Business Administration
CBT&A	Competency-Based Training and Assessment
CCI	Chamber of Commerce and Industries
CDCL	Construction Development Corporation Limited
CIDC	Committee for International Development and Cooperation
CII	Confederation of Indian Industry
CERG	Center of Excellence for Ready-made Garments
COEL	Center of Excellence for Leather Skill
CPS	Country Partnership Strategies
CSDC	Chittagong Skills Development Center
CTEVT	Council for Technical Education and Vocational Training
CTI	Center for Technopreneurship and Education
DAC	Development Assistance Committee
DBoM	District Board of Management
DPCCE	Department of polytechnic and Community Colleges
DTET	Department of Technical Education and Training
DTP	Dual Training Program
EDCF	Economic Development Cooperation Fund
EGP	English for General Purpose
ELT	English Language Teaching
ESP	English for Specific Purpose
FHEC	Fiji Higher Education Commission
FICCI	Federation of Indian Chamber of Commerce and Industry
FQF	Fiji Qualifications Framework
GNI	Gross National Income
HSC BM	Higher Secondary Certificate in Business Management
HSC VOC	Higher Secondary Certificate in Vocational Education
IIL	Industry-Institute Linkages
ILO	International Labor Organization
IMC	Institute Management Committee
IR 4.0	Industrial Revolution 4.0
ITE	Institute of Technical Education
IZC	Institute of Zorig Chusum
KOICA	Korea International Cooperation Agency

LED	Light Emitting Diode
LIC	Life Insurance Company
MBA	Masters of Business Administration
MOEF	Ministry of Economy and Finance
MOFA	Ministry of Foreign Affairs
MoHE	Ministry of Higher Education
MSDC	Ministry of Human Resources Development
NA	Needs Analysis
NAITA	National Apprentice and Industrial Training Authority
NAVTTC	National and Vocational Technical Training and Commission
NCERT	National Council of Educational Research and Training
NGO	Non-Governmental Organization
NHDCL	National Housing Development Corporation Limited
NSDC	National Skill Development Agency
NVQ	National Vocational Qualification
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
OJT	On-the-Job training
PCB	Printed Circuit Board
PPE	Personal Protective Equipment
PSSCIVE	Pandit Sundarlal Sharma Central Institute of Vocational Education
PTS	Pokhara Technical School
R&D	Research and Development
RAC	Refrigeration and Air-conditioning
REAP	Regional Entrepreneurship Accreditation Program
RIE	Research, Innovation and Enterprise
SDGs	Sustainable Development Goals
SSC	Sector Skills Councils
T&L	Teaching and Learning
TESDA	Technical Education and Skills Development Authority
TSLC	Technical School Leaving Certificate
TTI	Technical Training Institute
TVET	Technical Vocational Education and Training
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEVOC	UNESCO Vocational Education
UNIVOTEC	University of Vocational Technology
WEF	World Economic Forum

ISO 9001:2015
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