

Practices of Green Technology among TVET Professionals in Pakistan

**Rajput Abdul Ghani*

Colombo Plan Staff College Manila, Philippines

Muhammad Naeem Akhtar

GIZ-TVET Reform Support Programme, Pakistan

**Corresponding author: a.g.rajput@cpsctech.org*

ABSTRACT

Green technology concept is getting prominent in Pakistan. The overarching aim of green technology is to ensure clean environment and to sustain biodiversity. The importance of sustainability as stipulated in the United Nations Sustainable Development Goals (SDGs) lies in its comprehensive framework that addresses the interconnectedness of economic, social, and environmental dimensions. However, based on the literature, the readiness of the present workforce for the coming green economy is a challenging task for Technical Education and Vocational Training Authority (TEVTA) in Pakistan. Hence, the purpose of this research was to identify the practice of TVET professionals regarding green technology in Pakistan. A sample of 30 TVET professionals across Pakistan was randomly selected. The research found that most of the TVET professionals strongly agreed regarding the importance of Pakistan to possess green technology. However, the respondents were moderately agreed regarding the usage and application of green technology in their daily lives.

Keywords: TVET practitioners, green technology, greening TVET, technology acceptance model, Pakistan

INTRODUCTION

Transition to a green economy is posing formidable challenge to the training providers and TVET sector in Asia (Mustapha, 2015). In Pakistan, green education still faces significant challenges in terms of curriculum integration, teacher training, infrastructure, and policy prioritization. While some private and urban schools have made progress, the majority of public and rural schools lack the resources and support needed to implement environmental education effectively (Tariq et al., 2020). According to Mustapha (2015; 2019), with the diminishing of fossil fuel, the world is considering for viable alternatives in terms of generating renewable energy. “Digital Pakistan” initiative is spearheaded by the government that aimed to use green technology for country's social welfare, which further be enhanced for achieving environmental sustainability over a time horizon (Nizam et al., 2020). United Nations report on Green Technological Transformation asserts that overall assessment on the countries’ policy on the environment is critical (Mustapha et al., 2019).

To achieve green growth, it is important to ensure the low carbon green technologies are used (Anbumozhi, 2015). To preserve eco-friendly quality, a country needs clean air, non-toxic water, renewable energy, stable climate, and effective green waste management. Forthcoming generation is imagining a better world for them and sustaining the mother earth

must start with green awareness from the early age (Mustapha et al., 2019). However, literature has shown that awareness of green practices and products among professionals and students are only moderate (Chin & Ng, 2015). An online survey was conducted by Taylor and Creech (2012) in which 30 TVET administrators and teachers were the respondents. About 13% of the respondents described themselves as having “no knowledge at all of the concept of education for sustainable development,” and 50% said they had “heard of the concept, but have no detailed knowledge of it.” Only 3% of respondents felt they knew the concept “very well” (Taylor & Creech, 2012). However, there are few empirical studies in Pakistan about green skills and the usage of green technology by TVET practitioners. Thus, the purpose of the research was to identify green technology perception among TVET professionals in Pakistan.

BACKGROUND OF THE STUDY

In the context of epistemology of green skills, it is defined as the abilities to perform and solve problems in the green occupations (Strietska-Ilina et al., 2011). They include the mindset, knowledge, abilities, and attitudes that an individual possesses to live in, to work in, to develop and to support a sustainable and resource-efficiency environment. According to Pavlova (2017), green skills are the competencies and abilities that enable individuals to contribute effectively to sustainable development and environmental protection. These skills include knowledge of environmental issues, eco-friendly practices, resource management, and the ability to innovate and implement solutions that promote sustainability in various sectors such as industry, agriculture, and urban development.

Green technologies refer to innovative products, services, and processes that aim to reduce environmental impact and promote sustainability (Venkadeshwaran, 2019). These technologies are designed to minimize resource consumption, reduce pollution, and enhance energy efficiency. Several main characteristics of green technologies include energy efficiency, pollution reduction, resource management, innovative solution, and sustainability.

Green talents are needed in sectors such as renewable energy, water and waste management, rainwater harvesting, conservation of energy and, reducing pollution (Mustapha, 2015). Basically, green skills give rise to green economy and green economy gives rise to economic development that is sustainable in the long-run. In other words, green skills are essential for fostering a workforce capable of addressing climate change, reducing environmental impact, and supporting the transition to a greener economy.

The Rio Declaration and Kyoto Protocols are the two important declarations on the environment besides the Earth Charters (Mustapha et al., 2019). These world initiatives were designed to protect this planet from environmental harmful activities and to sustain balance development (Mustapha et al., 2019). The countries that signed in must show commitment to implement the declaration and protocols based on green paradigm. As such, green technology, green economy and green lifestyle are on the top priority list of the United Nations’ agenda in order to sustain the mother earth and to reduce global warming.

Majumdar (2011) has proposed that a greening strategy by inserting green paradigm in Technical and Vocational Education and Training (TVET). TVET is a prime platform to provide technical workforce. He suggests ‘greening’ TVET by introducing five components of institutional operations to extend sustainable development principles in TVET institutions. These five components are as follows:

- Green Culture
- Green Campus
- Green Curriculum
- Green Community
- Green Research and Technology

Mustapha et al. (2019) argued that in the green paradigm, issues relating to education and training should be viewed in the overall context of education for sustainable development. They suggested that the nurturing of green mindset is the utmost importance to spearhead green revolution. However, 'green' education and training are constrained by several factors such as slow responsiveness of education and training institutions in creating futuristic curricula for green jobs. Green jobs are closely related to green technology and contribute to green economic prosperity. Green technology refers to eco-friendly, clean and environmental-friendly technology designed to preserve nature and natural resources (Mustapha & Mat Abu, 2014). Therefore, improving green education and training in terms of intensifying green awareness, green knowledge and skills of the existing principal, trainers, instructor, and the future generation is critical.

According to Sultan et al. (2016), environmental awareness among students, teachers, and school administrators in Pakistan was relatively high but the green practices were moderate. Green skills are important especially for TVET educators so that they could teach students about importance of green technologies and to adopt effective practices. In Pakistan, societal actors may be preoccupied with the economic survival than to worry about environmental quality. It is often said that not-so-rich countries focus on the 'development' and those of richer countries pay attention to the 'environment'. Hence, the ways to achieve sustainable development remain ambiguous (Mustapha, 2015). Based on United Nations (2013) statistics, the world population will reach 9.6 billion people by 2050, from 7.2 billion today. Hence, if the current modes of consumption continue, the resources of 'two' planet earths may be required to sustain the population in 2050. Examples of green technologies include solar panels, wind turbines, electric vehicles, biodegradable materials, and energy-efficient appliances. In the nutshell, green technologies play a crucial role in addressing environmental challenges and advancing sustainable development.

PROBLEM STATEMENT

Implementing green initiatives in Pakistan faces several challenges, including lack of awareness of the importance of green education, circular economy and green technologies. According to Aslam Khan and Pervaiz (2012:7):

The dilemma faced by Pakistan is typical of countries wanting to follow the high growth curve and choose between economically growing first and then environmentally "cleaning up" later or deciding on the more sustainable and prudent, but seemingly more expensive, option of preventing or mitigating environmental damage while developing. The issues of unregulated growth including unplanned and rapid urbanization, untenable pressure on natural resources such as forests and water, heavy dependence on the finite fossil fuel-based energy, air and water pollution are all demanding a global rethink.

In addition, the significant segment of the population and businesses may not fully understand the importance of green initiatives or how to implement them effectively. In addition, political instability and limited financial resources may reduce green projects and deter external investment on green technologies in Pakistan. Generally, high initial costs associated with green technologies and projects can deter investment. In terms of regulatory and policy challenges – inconsistent policies, lack of enforcement, and bureaucratic hurdles can hinder the effective implementation of green initiatives in Pakistan (Khan et al., 2021). Moreover, inadequate infrastructure, such as unreliable energy grids and poor waste management systems, can limit the effectiveness of green technologies.

Green Education

Initiatives like school recycling programs and green curricula are still in their infancy in Pakistan – they are characterised by inconsistent execution and a small presence in public or rural schools. Although a few private and urban schools demonstrate a dedication to

environmental education, nationwide adoption is still difficult. While there are some promising efforts, they are far from widespread or effective on a national scale. In terms of green curriculum, the Single National Curriculum (SNC) includes some environmental topics, such as climate change, water conservation, and tree plantation, particularly in science and social studies (Gul & Mahmood, 2021). Private and elite schools often offer more robust environmental education, eco-clubs, and project-based learning on sustainability. However, in public schools and rural areas, green education is minimal or theoretical, with little emphasis on practical environmental literacy or hands-on activities.

Regarding recycling initiatives, a few urban schools, especially in cities like Lahore, Karachi, and Islamabad, have introduced recycling bins, composting, and eco-awareness campaigns (Shafique & Clark, 2022). These are often pilot programs, driven by NGOs, international donors, or school-level enthusiasm – not part of a nationwide policy. In most schools, especially in under-resourced areas, waste segregation and recycling practices are less visible.

Other critical challenges include lack of trained ‘green’ teachers in most schools in Pakistan (Javed et al., 2020). The majority of Pakistani teachers are not trained in environmental education or how to deliver it in an engaging, practical way. And there is little investment in teacher capacity-building around sustainability themes (Khan, Jamshaid, & Ramzan, 2019). In general, school curriculum still lacks localized, hands-on environmental learning. Topics like circular economy, renewable energy, pollution mitigation, or recycling are not well integrated, especially in primary or middle grades. In terms of green infrastructure, most schools lack basic infrastructure — like recycling bins, clean water, proper sanitation — making environmental practices hard to implement (Javed et al., 2020). Without adequate green facilities or support infrastructure – recycling and waste management are difficult to institutionalize.

Furthermore, environmental initiatives in Pakistan are mostly urban-centric (Government of Pakistan, 2015). Rural schools face deeper resource constraints and limited exposure to sustainability education (Khanum, 2019). In brief, environmental education in Pakistan has not been a strong policy priority as compared to issues such as literacy and numeracy. Funding and administrative focus on green education is minimal. Nevertheless, based on several studies, there are opportunities for improvement which include:

- integrating practical green activities into school life (e.g., tree planting, waste segregation, school gardens),
- partnering with local NGOs for green awareness drives and recycling programs,
- training teachers in experiential environmental education, and
- using digital platforms to introduce green content where physical infrastructure is lacking.

In the nutshell, literature has shown that the demand for green education is increasing in Pakistan. Hence, a clear green policy and action plan is needed to strengthen environmental education in Pakistani schools. In addition, proper green ecosystem and green infrastructure are required to act like a catalyst for green development. The implementation of green curricula and recycling initiatives in Pakistani schools is progressing, albeit unevenly, with several challenges as mentioned as the barriers for widespread adoption.

Current Green Curriculum

In Pakistan, the Single National Curriculum (SNC) incorporates environmental topics such as climate change and conservation (Gul & Mahmood, 2021). However, the integration is often superficial, lacking depth and practical application. Private and elite schools in urban areas tend to offer more comprehensive environmental education, including eco-clubs and sustainability projects. In contrast, public schools, especially in rural regions, often lack the resources and trained personnel to implement such programs effectively.

Green Initiatives

Some schools in Pakistan have initiated recycling programs and eco-awareness campaigns, primarily driven by NGOs and international donors (Shafique & Clark, 2022). However, these initiatives are not standardized across the education system, leading to inconsistent practices and limited impact. Furthermore, the challenges to implement green TVET are varied.

First, significant number of schools lack of basic infrastructure, such as recycling bins and clean water facilities, making it difficult to implement environmental practices. Second, limited ‘green’ teacher training. Educators often do not receive adequate training in environmental education – hindering their ability to teach and inspire students effectively (Sultan et al., 2016). Third, the existing curriculum does not prioritize environmental education, and there is a lack of interdisciplinary approaches to integrate sustainability topics across subjects. Fourth, green initiatives are predominantly urban-centric, with rural schools facing greater challenges due to limited exposure and resources. Fifth, there is a lack of cohesive national policies and administrative support to standardize and promote environmental education across Pakistani schools.

The other suppressive factors that could hinder the rapid pace of greenization in Pakistan include the cultural resistance. Traditional practices and ‘resistance to change’ can impede the adoption of new, green and sustainable technologies. In addition, economic prioritization often takes precedence over environmental concerns – leading to a focus on short-term gains rather than long-term sustainable practices. Next, Pakistan is often vulnerable to climate change, which can complicate the planning and execution of green initiatives. Moreover, insufficient investment in R&D for local green technologies may lead to a heavy reliance on imported solutions that may not be suited to local conditions. Addressing these challenges requires a multi-faceted approach, including increased public awareness, supportive policies, and investment in green infrastructure and education. In the nutshell, the slow progress in implementing green curricula and recycling programs in Pakistani schools has hindered widespread ‘green’ adoption. Addressing these issues requires concerted efforts from policymakers, educators, and communities to foster an environmentally conscious and sustainable educational environment.

PURPOSE OF THE STUDY

The purpose of the study was to identify the practice of green technology based on the perception of TVET professionals in Pakistan. In this study, TVET professionals included TVET educators, administrators and practitioners. The respondents were randomly selected from Technical Education and Vocational Training Authority (TEVTA) of Pakistan. Furthermore, the usage of green technology applications in TVET institutions were also surveyed.

RESEARCH QUESTIONS

The following are the research questions formulated for this study.

1. What are the perceptions of TVET professionals regarding the roles of green technology?
2. What are the TVET professionals’ practices in using green technologies?
3. What are the TVET professionals’ efforts to sustain the environment?
4. To what extent the TVET professionals adopt the recycling practices at workplace?

THEORETICAL AND CONCEPTUAL FRAMEWORKS

Green skills refer to the knowledge, abilities, and competencies that enable individuals to contribute to sustainable development and environmental conservation (Pavlova, 2017). These skills are essential for promoting eco-friendly practices in various sectors, including energy,

agriculture, manufacturing, and waste management. Green skills encompass a range of competencies, such as environmental awareness, renewable energy knowledge, sustainable resource management, waste reduction techniques, and sustainable agriculture practices (Maclean et al., 2018). In the literature, it has been identified that ‘development’ and ‘environment’ could be the two opposite sides. If a government focuses on development, it may cost the environment. If a country puts high emphasis on development, it may ‘sacrifice’ the environment. Hence, United Nations (2011) supports that development and environment as not contraries but they are complimentary and mutually supportive obligations. Based on SDGs, countries need to achieve low-carbon, enforce resource-efficient strategies and adopt green economic model. In brief, green skills are critical for fostering a workforce capable of addressing climate change and promoting sustainable practices in various industries.

The theoretical framework for this study was based on two models: (a) an integrated model of green ecosystem and (b) Technology Accepted Model (Davis, 1989). This first model includes not just the socio-economic but also the nature related (i.e., ecological) attributes of well-being and that incorporates cultural and natural diversity, could appropriately address sustainable well-being.

The second model is the technology acceptable model (TAM) introduced by Davis (1986) – is one of the most widely used models to explain user’s acceptance behaviors. The model focuses on users’ awareness on usability of a technology. The model contains elements such as (a) perceived usefulness (PU) and (b) perceived ease-of-use (PEOU). This model is an extension to the theory of reasoned action by Ajzen and Fishbein (1975). This model accepts some forms of meanings to act. This model is grounded in social psychology theory in general and the Theory of Reasoned Action (TRA) in particular (Fishbein, & Ajzen, 1975). TRA asserts that beliefs influence attitudes, which lead to intentions and therefore generate behaviors. Figure 1 shows the application of TAM model in the conceptual framework of the study.

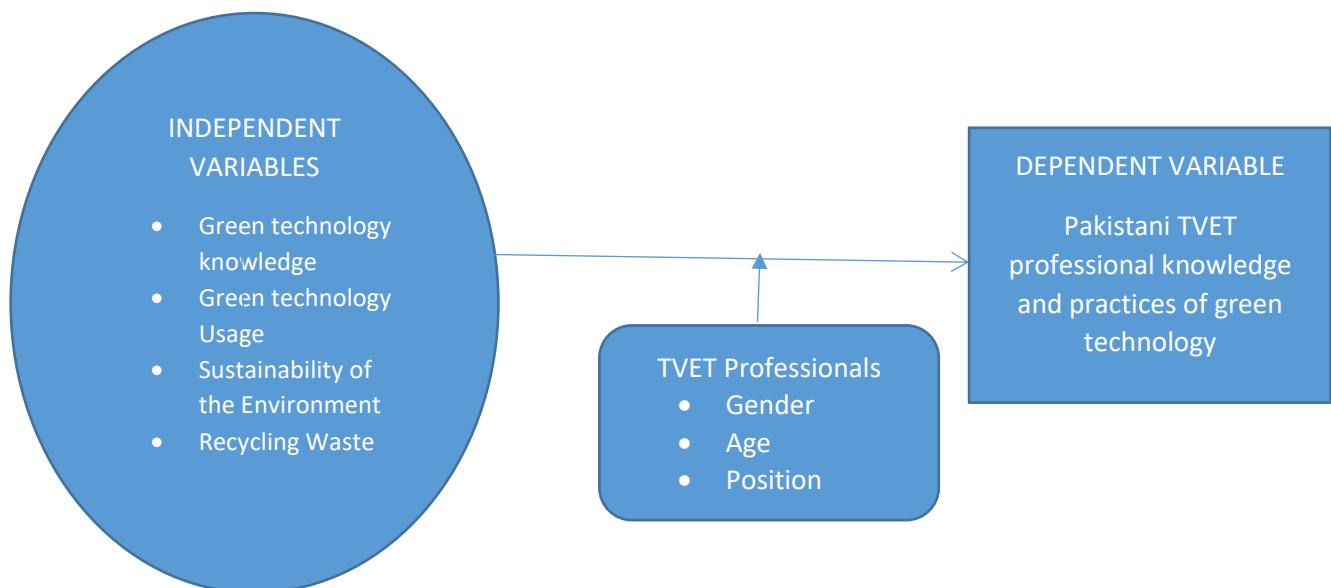


Figure 1: Conceptual Framework

RESEARCH METHODOLOGY

The research design used in this research was a case study with multiple sites with multiple cases. A sample of 30 vocational educators from a population of 54 TVET principals, teachers, and practitioners from different public TVET centers in Pakistan was selected randomly. A set of questionnaires was built based on the research objectives and the conceptual framework. The 5-point Likert scale questionnaire (1=Strongly Disagree; 2=Disagree; 3=Uncertain; 4=Agree;

5=Strongly Agree) was validated in a pilot test by three experts in the field. Green perception and practice of TVET professionals were measured in this empirical research.

The instrument for data collection consisted of a structured questionnaire. The questionnaire has five sections. The first section sought information about the main demographics of the respondents such as gender, position, and age. The second section delved into the perceptions of TVET professionals regarding the roles of green technology. The third section dealt with the TVET professionals' practices in using green technologies. The fourth section was about the TVET professionals' efforts to sustain the environment. The last section highlighted the TVET professionals' adoption of the recycling practices at their workplace.

RESULTS

Demographics Variables

In this section, demographics variables are defined. The total number of respondents was 30 TVET professionals. They were randomly selected. Figure 2 shows the gender of the respondents.

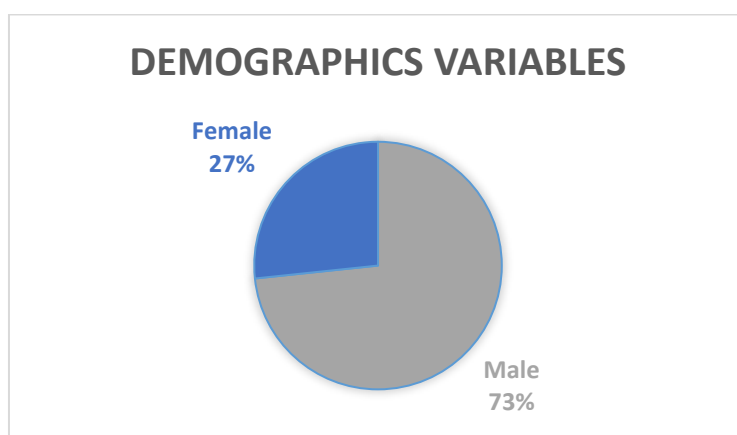


Figure 2: Demographic variables information

More than two-thirds of the respondents (73%) were males and only 27% were female respondents. This is because there were more males in TEVTA in Pakistan. In terms of the age bracket, the majority of the respondents were between 31 – 40 years old.

Green Technology Perception

Regarding the perception of the respondents regarding the roles of green technology (see Table 1), in general, the TVET professionals showed positive attitude toward green technology ($M=4.46$; $SD=0.66$). They strongly agreed that green technology was important to achieve sustainable development ($M=4.42$; $SD=0.68$) and it could be used to reduce greenhouse effect ($M=4.53$; $SD=0.66$). Respondents also recognized that green technology is beneficial for their personal health ($M=4.60$; $SD=0.66$) and it could boost economic growth ($M=4.33$; $SD=0.70$). Finally, they believed ($M=4.43$; $SD=0.61$), green public awareness is important to enhance people's knowledge of green technology.

Table 1: The roles of green technology

No	Items	Mean (M)	Standard Deviation (SD)
1	I believe green technology is important to achieve sustainable development	4.42	0.68
2	I believe more trees should be planted to reduce greenhouse effect	4.53	0.66
3	I believe green technology is beneficial for personal health	4.60	0.66
4	I believe a country's economic growth will improve by adopting green technology	4.33	0.70
5	I believe green public awareness is important to enhance people's knowledge of green technology	4.43	0.61
Total average:		4.46	0.66

Table 2 displays the green technology usage among the TVET professionals. In terms of green practice, in general, the respondents were uncertain ($M=3.37$; $SD=0.93$) whether they practiced green lifestyle in their daily lives. The TVET professionals were unsure ($M=3.22$; $SD=0.69$) whether they used green technology for health reasons. They also were seldom bought organic-based foods ($M=3.05$; $SD=1.10$) and were still using CFC sprays ($M=3.10$; $SD=0.99$). However, the respondents barely agreed ($M=3.54$; $SD=0.86$) that they bought stuff made from recycled materials. Finally, the respondents agreed ($M=3.97$; $SD=1.05$) that they practiced recycling at home and their workplace.

Table 2: Green technology usage

No	Items	Mean (M)	Standard Deviation (SD)
6	I use green technology to create healthy environment	3.22	0.69
7	I use organic foods to reduce the usage of chemicals in my daily diet	3.05	1.10
8	I stop buying spray that contains CFC because CFC is harmful to the ozone layer.	3.10	0.99
9	I bought stuff that can be recycled or made from recycled materials.	3.53	0.86
10	I practice recycling in my home and workplace	3.97	1.05
Total average:		3.37	0.93

The positive attitude of TVET professionals toward saving the environment ($M=4.04$; $SD=0.74$) can be seen in Table 3. The respondents strongly agreed ($M=4.53$; $SD=0.79$) that the usage of green technology will reduce the global warming. Most of the respondents agreed ($M=3.99$; $SD=0.71$) that they develop plan to use green technology in their workplace. Majority of the respondents strongly agreed ($M=4.30$; $SD=0.74$) that they have planted trees surrounding their workplace to protect the environment. However, they barely agreed ($M=3.53$; $SD=0.72$) that they joined environmental campaign to use green technology. In the nutshell, the respondents believed that green technology will decrease global warming, if they decide to use green technology in their future workplace. In addition, the respondents claimed to have planted trees but they did not very often join the environmental movements.

Table 3: Sustainability of the environment

No	Items	Mean (M)	Standard Deviation (SD)
11	I understand the green technology helps us to decrease global warming.	4.35	0.79
12	I develop a plan to use green technology to be used in my workplace	3.99	0.71
13	I plant seeds and trees surrounding my workplace to protect the environment	4.30	0.74
14	I join environmental campaign to use green technology	3.53	0.72
Total average:		4.04	0.74

Regarding recycling waste (see Table 4), the respondents claim that they used recycled papers (M=3.99; SD=0.98) and throw toxic materials properly (M=3.80; SD=0.78). Further, TVET professionals strongly agreed that they did not throw rubbish to the drains (M=4.20; SD=0.62) and used water carefully so that the water was not wasted (M=4.40; SD=0.69). In general, the respondents agreed (M=4.09; SD=0.76) that they used ‘green’ materials and recycled the wastes. In the nutshell, the results showed that the respondents claimed to have practiced recycling wastes and reduced the usage of water.

Table 4: Recycling waste

No	Items	Mean (M)	Standard Deviation (SD)
15	I practice recycled papers	3.99	0.98
16	I appropriately throw away toxic chemicals in their specific container	3.80	0.78
17	I do not throw garbage into drain	4.20	0.62
18	I use water minimally in order not to waste this precious resource	4.40	0.69
Total average:		4.09	0.76

At the end of the questionnaire, three open-ended questions about greening TVET and suggestions for additional ideas to enhance green practices among TVET professional in Pakistan were posited. As expected, 80% of the respondents were able to provide greening TVET examples such as using renewable energy and green technologies including using solar panel, hybrid car, and hydroponic. Others provided suggestions to use environmentally friendly practices such as recycling, planting trees, use ‘green’ bags (other than plastics). The respondents also suggested strategies to promote greater usage of green technologies at their workplace. The most unique idea was to conduct green technologies competition among TVET students and practitioners.

CONCLUSION AND RECOMMENDATIONS

In a nutshell, the sample comprised TVET professionals from several TVET insitutions in Pakistan – the sample was mostly aged between 31 to 40 years old. The majority of the respondents was male (73%) and they were mainly TVET teachers. Regarding the first objective of the study, the empirical data showed that most TVET professionals possessed positive attitude toward green technology. In other words, the respondents strongly agreed that green technology was essential and it could improve their quality of life. However, when it

comes to the usage of green technologies (second objective) in their daily lives, the respondents seemed to be uncertain about their real practice with regard to green technologies. In other words, in terms of the practicing the green technology, the respondents provided polarized replies. Nevertheless, the respondents agreed that sustainability of the environment (third objective) is very important. For the final objective, the respondents claimed that they recycled their wastes. In sum, the data seem to suggest that green standards and thinking must be inculcate among TVET students through greening TVET concept. Based on the findings and limitations of the study, several recommendations can be suggested:

- TVET professionals should play a pro-active role in adopting and implementing greening TVET in their institutions.
- Incorporating hands-on environmental projects, such as school gardens and waste segregation, to enhance student engagement.
- Strengthening teacher training such as developing specialized training programs to equip teachers with the necessary skills and knowledge.
- Developing and implementing national policies that mandate and support environmental education and practices in schools.
- Establishing community and NGO partnerships such as collaborating with local organizations to provide resources and expertise for environmental initiatives.

ACKNOWLEDGEMENT

The authors gratefully acknowledged the support of directors, principals, and trainers from TEVT Authorities for the data collection. Authors also acknowledges the efforts of Mr. Nadeem Iqbal, Director PVTC, Pakistan who supported and participated in the data collection process.

REFERENCES

- Anbumozhi, V. (2015). *Low carbon green growth in Asia: What is the scope for regional cooperation. ERIA Discussion Paper Series (ERIA-DP-2015-29)*. Paper presented at the symposium on Advancing Sustainability Research and Education held in Indian Institute of Management, Bangalore on 5-7 January 2015.
- Ajzen, I. & Fishbein, M. (1975). *Belief, attitude, intention, and Behavior: An introduction to theory and research*. Reading, MA: Addition-Wesley.
- Aslam Khan, M.A., & Pervaiz, A. (2012). *National sustainable development strategy Pakistan's pathway to a sustainable and resilient future*. UNDP.
- Chin, C.M., & Ng, Y.J. (2015). A perspective study on the urban river pollution in Malaysia. *Chemical Engineering Transactions*, 45, 745-750.
- Davis, F.D. (1986). *A technology acceptance model for empirically testing new end-user information systems: theory and results*. Doctoral dissertation. Cambridge, MA: MIT Sloan School of Management.
- Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance. *MIS Quarterly*, 13(3), 319-340.
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behaviour: An introduction to theory and research*. Reading, MA: Addison-Wesley.

- Government of Pakistan (2015). *National Report of Pakistan for Habitat III*. Islamabad, Pakistan: Ministry of Climate Change.
- Gul, M., & Mahmood, F. (2021). *Single National Curriculum: Is the environment missing?* Technical Report. 360 Degree Review.
- Javed, A., Akhtar, N., Iqbal, K.M.J., Naseer, H.M., Amir, S., & Khan, M.I. (2020). Infusion of environmental education in secondary school science curricula in Pakistan. *Elementary Education Online*, 19 (Issue 3), 3059-3069.
- Khan, A.M., Jamshaid, A., & Ramzan, A. (2019). Educators, as agents of sustainable development in Pakistan. *The Journal of Educational Research* 22(2), 1-14.
- Khan, S.U., Manzoor, Z., Rajaguru, G., & Syed, S.H. (2021). Sustainable development in Pakistan: Vulnerabilities and opportunities. In Low, P.S. Low (Ed.). *Sustainable development: Asia-Pacific perspectives*. Cambridge: Cambridge University Press.
- Khanum, A. (2019) *Environmentally conscious global citizens: An evolution from environmental education to education for sustainable development in Pakistan*. PhD thesis. University of Glasgow, United Kingdom.
- Majumdar, S. (2011). Developing a greening TVET framework. In UNESCO/UNEVOC, CSP, GIZ: Transforming TVET for Meeting the Challenges of the Green Economy. Report of the International Consultation Meeting (pp. 27-30).
- Maclean, R., Jagannathan, S., & Panth, B. (2018). *Education and skills for inclusive growth, green jobs and the greening of economies in Asia: Case study summaries of India, Indonesia, Sri Lanka and Vietnam*. Singapore: Springer.
- Mustapha, R. & Mat Abu, S.S. (2014). Perspective of technical students on green technology: A case study in a Malaysian public university. Proceedings of 10th Conference of AASVET (Asian Academic Society for Vocational Education and Training), Tokyo. 194-205.
- Mustapha, R. (2015). Green and sustainable development for TVET in Asia. *Invotec*, 11(2), 133-142.
- Mustapha, R., Nashir, I.M., & Ma'arof, N.N.M.I. (2019). Awareness of green technology among engineering technology students. *Journal of Engineering Science and Technology*, Special Issue on ICEES2018, June, 1-8.
- Nizam, H.A., Zaman, K., Khan, K.B., Batool, R., Khurshid, M.A., Shoukry, A.M., Sharkawy, M.A., Aldeek, F., Khader, J., & Gani, S. (2020). Achieving environmental sustainability through information technology: "Digital Pakistan" initiative for green development. *Environmental Science and Pollution Research*, 27, 10011 – 10026.
- Pavlova, M. (2017). Green skills as the agenda for the competence movement in vocational and professional education. In M. Mulder (Ed.), *Competence-based vocational and professional education: Bridging the worlds of work and education* (pp. 931–951). Singapore: Springer International Publishing.
- Shafique, S. & Clark, T. (2022). *Waste management in Pakistan*. European Commission.

- Strietska-Ilina, O., Hofmann, C., Durán Haro, M., & Jeon, S. (2011). *Skills for green jobs – a global view: Synthesis report based on 21 country studies*. Geneva: International Labour Office.
- Sultan, S., Ajmal, M., & Lodhi, M. F. (2016). environmental awareness among trainee teachers at tertiary level in Pakistan: Need, scope, challenges and opportunities. *Bulletin of Education and Research*, 38(2), 123-134.
- Tariq, S., Sultan, S., & Choudhary, F.R. (2020). Environmental education and practices in Canada, Turkey & Pakistan at primary level: A content analysis. *Research Journal of Social Sciences and Economics Review*, 1(4), 389–400.
- Taylor, S.K. & Creech, H. (2013). Technical-vocational education for sustainable development in Manitoba. International Institute for Sustainable Development.
- United Nations (2011). *The great green technological transformation*. New York: United Nations.
- United Nations (2013). *World population projected to reach 9.6 billion by 2050*. Retrieved October 15, 2018 from <http://esa.un.org/unpd/wpp/index.htm>
- Venkadeshwaran, K. (2019). Green technology and its effect on the modern world. *JETIR*, 6(3), 230-237.