Factors Impacting TVET Pre-Service Teachers' Intention to Integrate Education for Sustainable Development in Learning and Facilitation: A Pilot Study

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DOI: https://dx.doi.org/10.47772/IJRISS.2025.908000172

Received: 28 July 2025; Accepted: 02 August 2025; Published: 02 September 2025

ABSTRACT

Education for Sustainable Development (ESD) is an education that teaches people about life by caring for or protecting the environment and supporting social well-being and economic growth. It carries the concept of Sustainable Development Goals (SDGs) 4, which emphasizes quality, inclusive, and equitable education. In the context of TVET, ESD integration plays an important role in producing a prospective workforce who is skilled in solving sustainability issues and capable of facing future labour market transformations. TVET is a dynamic education that has a great role and responsibility for the country's economic growth. However, this success will not be achieved if the learning and facilitation process in TVET institutions is not implemented according to real ESD practices. The respondents in this pilot study ($N = 30$) who have almost the same characteristics as the study sample which is they have experience in teaching practical in school. The survey instrument has 83 items consisting of the demographic division of the respondents, six part of factors (Pedagogical Content Knowledge, Project-Based Learning, Assessment and Evaluation, Professional Development, Professional Practice, Attitude) and ESD Integration Intentions. The results of the reliability analysis using the Statistical Package for Social Sciences (SPSS) version 27 showed that all items of each factor were accepted as Cronbach's Alpha value exceeded the value of 0.90. Overall, the pilot test findings demonstrated that each component contributed to a shift in pre-service teachers' intentions to incorporate ESD into teaching and facilitating.

Keywords— Education for Sustainable Development (ESD), Sustainable Development Goals (SDGs), Technical and Vocational Education and Training (TVET), Pre-Service Teacher, ESD Integration Intentions

INTRODUCTION

In the early 1990s, Education for Sustainable Development (ESD) was introduced to support the process of disseminating UNESCO's initiatives in achieving sustainable development success through the education sector. Almost every year, UNESCO conferences are held which are attended by United Nations countries to discuss and present issues, challenges and implementation in the context of 17 sustainable developments, especially ESD development. Stefania Giannini (2020) has published a book that tells the story of a global framework to implement ESD over a 10-year period from 2020 to 2030. This framework is also known as ESD for 2030, where he asserts that ESD will contribute to 17 SDGs. His writing also explains that ESD is an education that educates people about life by caring for or protecting the environment and supporting social well-being and economic growth. Moreover, geared towards Technical and Vocational Education and Training (TVET), ESD plays a very important role and is responsible in equipping students with knowledge, skills and attitudes that aim to meet career needs to overcome sustainability challenges.

So, this study is very important to carry out because various ESD issues have been the topic of study by scholars but focus more on awareness compared to implementation effects. This study involves several educational factors such as pedagogical content knowledge, project-based learning, assessment and evaluation, professional development, professional practices and attitude. These factors were used to assess the effect as well as the relationship on TVET pre-service teachers' intentions to integrate ESD in learning and facilitation. This is

because studies involving the application of ESD are still not actively carried out among pre-service teachers, especially in the field of TVET.

This paper discusses the literature review and analyzes the results based on pilot test study which includes an understanding of ESD, and the competency factors of TVET pre-service teachers involved as well as presenting a proposed conceptual framework for this study.

Education for Sustainable Development (ESD)

At the beginning of the emergence of the concept of sustainability (SD), countries around the world showed concern and awareness about the future state of the world, particularly regarding human life and the quality of life for future generations. Research has indicated that environmental impacts have significant effects on human life (Pavlova, 2009). Therefore, UNESCO has been one of the agencies driving this concept of SD and has introduced Environmental Education (EE), later rebranded as Education for Sustainable Development (ESD) (Robottom, 2007).

UNESCO has introduced three pillars of ESD encompassing social, economic, and environmental aspects (Samuellson & Siraj -Blatchfo, 2015). These have been developed further into five principles of ESD: learning to know, learning to be, learning to live together, learning to do, and learning to transform, which align with the main pillars of SD involving society, planet, prosperity, peace, and partnership (UNESCO, 2012). All these principles and pillars are interconnected to achieve the success of a nation based on sustainable development from all aspects.

The practice of ESD is categorized as lifelong education that is highly suitable for all age groups and regions. This is because the content of ESD aims to raise awareness about issues that can impact society and the environment. Therefore, community cooperation, whether in urban or rural areas, plays a significant role as a transformative tool to achieve a safe, peaceful, and prosperous nation. For example, Ireland has implemented collaboration between educational institutions and their communities to widely disseminate ESD (Cotera, 2021).

Based on this example, it can be said that ESD can positively impact the development of a country's educational system. This is because the trend in ESD is expanding and is highly suitable for applying community-based learning that can hone students' personalities and skills. Thus, students will better understand the importance of a just and equitable community life, leading to a sustainable nation (J. O'Flaherty & M. Liddy, 2018).

Currently, Malaysia is moving towards becoming a developed nation where education is highly emphasized, whether general education or TVET. Therefore, ESD is progressively being incorporated into the national education framework at every level. This is evidenced by the Malaysia Education Blueprint 2013-2025, which aims to produce graduates with the knowledge, skills, and attitudes capable of facing future challenges (Ministry of Education Malaysia, 2011).

Factors that Impact TVET Pre-Service Teachers' Intentions

Pedagogical Content Knowledge

The integration of ESD into TVET education programs plays a role in preparing students to face the challenges of sustainable development. However, the success of this integration depends on the knowledge of pedagogical content among pre-service teachers. Studies have shown that teachers who have an advantage of knowledge of pedagogical content will be better prepared and able to design and implement ESD teaching more effectively (Saiful & Setyorini, 2022; Purwianingsih, Novidsa, & Riandi, 2022). Therefore, this factor involves understanding in delivering the teaching content using methods that are easy for students to understand as well as wisely applying strategies in various learning objectives.

While pedagogical content knowledge is important for ESD, there are some challenges in developing this knowledge among pre-service TVET teachers. One of the main challenges is the lack of integration of ESD into the TVET curriculum. Many TVET programs do not explicitly address sustainability, making it difficult for pre-

service teachers to develop the necessary pedagogical content knowledge (Chinedu, Wan Mohamed, & Ogbonnia, 2018). Additionally, there is often a lack of training and support for teachers in developing ESD-related pedagogical content knowledge, which can result in a lack of confidence and competence in teaching sustainability concepts (Chinedu & Mohamed, 2017).

Referring to the first type of research from the study of Fischer, et al. (2022) which includes the design of learning environments where it describes the elements of ESD in the development of teaching programs. Research in this field focuses on the content of sustainability knowledge and various pedagogical approaches that are effective and effectively applied in TESD institutions. In addition, the third type, which is measuring learning outcomes, also states that TESD can equip teachers with the value of awareness, knowledge and competence in the context of sustainability and related to pedagogical strategies.

Project-Based Learning Method

Higher Level Thinking Skills (KBAT) can be assessed through a student's ability to master complex thinking including creativity, innovation, problem-solving and decision-making skills (Ministry of Education Malaysia, 2023). The 21st Century Learning Concept (PAK21) is an educational approach to meet the needs of the 21st century world and it focuses on students' competencies to face this rapid change in the world (Safri & Jamaludin, 2022).

In this regard, project-based learning (PBL) is one of the key elements of PAK21 which uses KBAT skills in teaching and facilitation (Yusak & Ladin, 2019). According to him, PBL is often carried out by students in groups to create something that leads to the importance of education. For example, an article from (Ariza & Olatunde-Aiyedun, 2023) has shown a successful implementation of PBL towards sustainability education where they have developed an electric vehicle known as EOLO in Columbia by applying solar and wind energy sources.

This learning method has proven to be one of the initiatives of educators in encouraging student involvement, producing effective and meaningful learning, and implementing collaborative practices (Ariza & Olatunde-Aiyedun, 2023). Every project or assignment given to students needs to have a problem and carry out research, so this PBL also includes problem-based learning and inquiry. Therefore, this PBL opens up opportunities for students to be involved in real sustainability challenges by honing their problem-solving skills and equipping themselves in pursuing a career in the future.

Assessment and Evaluation

Assessment is used to understand the learning situation or situation which involves the process of obtaining data whether to determine grades or not based on students' progress and performance in a subject (Tontus, 2024). He also said that this assessment process runs when the results are used to plan or improve students' teaching and learning. As a teacher, the skill in interpreting and evaluating students' work plays an important role especially if you want to apply new elements such as ESD. This process can help pre-service teachers in the development of sustainability-related knowledge as well as be able to apply sustainability principles in their teaching and facilitation.

The results of the assessment are an assessment carried out on the assessment. Therefore, evaluation is an important part of the learning and teaching process because it includes the process of collecting, analyzing and interpreting the data needed to determine the effectiveness of an educational program or activity (Pawan & Neha, 2021). He also explained that this assessment is needed during the decision-making process in improving teaching and curriculum. It can be ascertained that if this assessment and assessment is not implemented correctly, the teaching and facilitation process will not be effective and effective due to the absence of continuous monitoring and improvement.

The assessment and assessment process is the final process to measure students' knowledge in cognitive, psychomotor and affective aspects where the TVET education system in Botswana receives full support in the aspects of monitoring, assessment and evaluation to control the quality and recognition of the TVET industry and their career employability (Jerald, Tawanda, Vijayaratnam, & K Rajanthran, 2024). Similarly, in Malaysia,

sustainability certification and recognition guidelines are adopted as benchmarks for quality assessment in TVET programmes which include elements of the ESD curriculum (Chinedu, Saleem, & Wan Muda, 2023).

Professional Development

In general, professional development will involve individuals who want to improve their existing skills and knowledge and in the context of education, it is like a learning opportunity that allows a teacher to adapt to changes in the system (Karacabey, 2021). He also elaborated that the support of educational institutions is also responsible in opening opportunities for the professional development of their teachers. This is said to be so because the teachers can make a positive contribution to their own institution in addition to the importance of their competence. Karacabey (2021) study also states that there are still institutional administrators who do not provide cooperation in the preparation of any planning of their teachers' professional development activities.

Based on the study Ithnain (2022) has shown evidence that the competence of vocational teachers is influenced by involvement in effective professional development, he also supports Karacabey (2021) study that the support and role of school administrators is the starting point for active teacher involvement. Thus, this has proven that to achieve sustainability, the cooperation of all parties is necessary to obtain more effective efforts and initiatives. In this regard, education and teachers are responsible for initiating progressive steps in integrating it.

As such, integrating ESD requires a diverse approach to strengthen learning and curriculum design that is more holistic and transformative. Tiwary (2023) also said that this professional development includes elements of teacher training which are carried out through physical and virtual courses or seminars to work together to apply the concept of ESD in the classroom.

Professional Practices

In the context of professional development, the increasing professional and competent knowledge and skills it has an impact on the professional practice exhibited. As a result, it is not focused on teaching practices but is also able to reflect the culture practiced in the surrounding society or educational institution (Yonke & Sally, 2019). Their discussion also listed the important things that are factors in this practice, namely the understanding of teaching, students, responsibilities and culture of the community as well as the school.

Ultimately, it has an overall impact on the development of the school ecosystem. The results of the writings of Pegalajar-Palomino, Burgos-García, & Martinez-Valdivia (2021) also stated that the implementation of ESD in the future involves professional practices which can also contribute to the welfare of the social environment. However, it has become one of the issues during the development of sustainability in higher education institutions due to the lack of professional competencies among educational students. Therefore, the study of these researchers has shown that education has a responsibility to promote sustainable development among the community.

Attitude and Intentions

Some researchers are of the opinion that integrating new practices into an institution requires efforts to empower and motivate the entire community because ESD studies that look at motivation are not implemented. This is said because psychological theory has discussed that intention will be one of the guidelines for changing the actual behavior of a human being (Stössel, Baumann, & Wegner, 2021). This is also supported by Vukeli´c (2022) who states that the intention of a teacher is an important act of expectation in this educational profession. His research is related to the readiness of students in the field of education to implement ESD which involves the intention and competence of teachers where he emphasized that in the context of the implementation of ESD, teacher competence is also an aspect of the intention to integrate ESD.

The studies analyzed by Fischer, et al. (2022) that include the types of research understanding student attributes have elaborated on the intra-individual characteristics of pre-service or in-service teachers that focus on the teacher's understanding and involvement in sustainability. Among the important elements of this research are knowledge, attitudes and values and it emphasizes that pre-service teachers need a perfect understanding of the

attributes and experience of in-service teachers to achieve successful integration of ESD and a career as an educator.

Some studies have shown that the importance of attitudes towards sustainability and social responsibility to society and the environment have been considered as key components in overcoming societal challenges today (Pegalajar-Palomino, Burgos-García, & Martinez-Valdivia, 2021). It has also outlined the impact of implementing values and attitudes that can open opportunities and balance economic development, the welfare of the local community and the surrounding environment. Therefore, the exposure of the concept of sustainability uses social transformation where values and attitudes are the main factors in efforts to implement ESD.

Conceptual Framework

Figure 1 presents the conceptual framework of this study is based on the Asia-Pacific ESD Teacher Competency Framework developed by the ESD Promotion Center at Okayama University, with its components adapted to align with the context of Technical and Vocational Education and Training (TVET). (Okayama University, 2020).

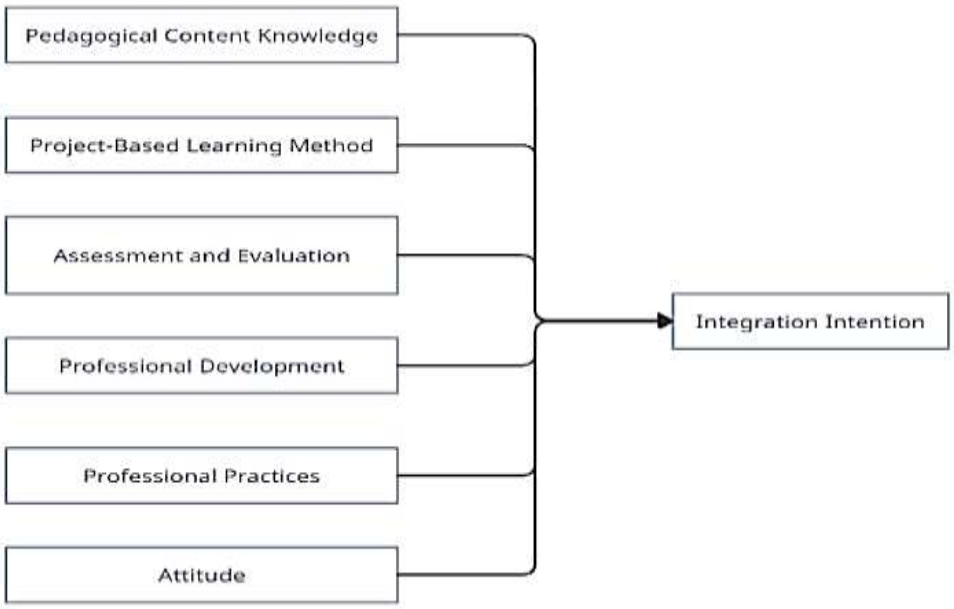

Figure 1: Conceptual Framework

METHODOLOGIES

A pilot study will be conducted before it is carried out on the actual sample of the study. This pilot study was small-scale where a minimum of 30 respondents was sufficient (Al-Emran, Mezhuyev, & Kamaludin, 2019). Researchers will use respondents who have almost the same characteristics as the study sample which is they have experience in teaching exercises. Therefore, the researcher will select graduates under the Department of Advanced Technical and Vocational Education and Training at UTM who are waiting for accepting or failing to get posting in school. This study needs to be emphasized in each quantitative study to ensure that the study instrument is effective.

This pilot study uses a survey method with a structured questionnaire to analyze the validation, reliability and descriptive statistics such mean and standard deviation to get the expected findings in real study by using Statistical Package for Social Sciences (SPSS) version 27. With reference to the instruments from Eliyawati, Widodo, Kaniawati, & Fujii (2023), this study instrument has been modified based on the field of TVET and includes 7 sections which has a total of 83 question items - Part A: Respondent Information, Part B: Pedagogical Content Knowledge Factors, Part C: Project-Based Learning Factors, Part D: Assessment and Evaluation Factors, Part E: Professional Development Factors, Part F: Professional Practice Factors, Part G: Attitude

Factors, Part H: ESD Integration Intentions.

FINDINGS

Instrument Validation

The validity process of the instrument is carried out before the pilot study is conducted. This aims to obtain reviews and reviews of each instrument item so that the planned objectives and measurements are successfully achieved (Kumar, 2011). This is to ensure that the results of a study are accurate and effective. In this quantitative study, the validity used is the validity of the content involving the researcher and experts in the field of study to obtain a consensus check stating the statement or survey question that is designed to represent the issue to be evaluated (Kumar, 2011).

Therefore, the instruments of this study will be handed over to 2 senior lecturers of the Department of Advanced Technical and Vocational Education and Training who have expertise in the development of sustainability and ESD education aimed at finding out the accuracy of each instrument item that look at the use of words and the appropriateness of sentences so that they are easily understood by the respondent.

Instrument Reliability

Based on the results of the pilot study, the researcher will conduct a reliability test of the instrument by looking at the Cronbach's Alpha value to make corrections or rejects to the instrument item. Based on the writings of Darwin, et al., (2021), the accepted value of Cronbach's Alpha must be above 0.90 which is based on

Table 1, mostly all of the item's variables had shown the accepted value which mean the instrument was at the perfect level.

VARIABLES	NUMBER OF ITEMS	CRONBACH'S ALPHA
Pedagogical Content Knowledge	24	0.980
Project-Based Learning Method	10	0.966
Assessment and Evaluation	9	0.972
Professional Development	10	0.945
Professional Practices	10	0.966
Attitude	10	0.950
Integration Intention	10	0.962
Total	**83**	**0.988**

Table 1: Instrument Reliability

Descriptive Statistics

A total of 30 respondents were involved in this pilot study which included 15 male graduates (50%) and 15 female graduates (50%) between the ages of 21 and 26 years and above. All these respondents consisted of graduates of University Technology Malaysia who had held a Bachelor of Technology and Education under the Electrical and Electronics (10%), Living Skills (26.7%), Mechanical Engineering (33.3%) and Building Construction (30%) programs.

ITEMS	MEAN	SD	MEAN LEVEL

Pedagogical Content Knowledge	3.31	0.55	Moderate
Project-Based Learning Method	3.39	0.60	Moderate
Assessment and Evaluation	3.29	0.63	Moderate
Professional Development	3.50	0.47	High
Professional Practices	3.44	0.58	Moderate
Attitude	3.51	0.53	High
Integration Intention	3.51	0.53	High

Table 2: Mean Scores for Variables

Based on

Table 2, the factors that showed high value were professional development and attitude with a mean of 3.50 and 3.51 respectively while the remaining factors namely knowledge of content pedagogy, project-based learning, assessment and assessment as well as professional practice were at a moderate level with mean values of 3.31, 3.39, 3.29 and 3.44. Other than that, the mean value of integration intention showed high value which is 3.51

DISCUSSION

The findings of this study reveal that pre-service teachers exhibit high levels of professional development, positive attitude, and strong intention to integrate educational practices such as ESD into their future teaching. This encouraging outcome is likely influenced by structured teacher education programs that emphasize continuous professional learning through workshops, microteaching, and reflective activities. These opportunities allow pre-service teachers to explore new strategies, receive feedback, and develop confidence. Additionally, the current generation of teacher trainees who are generally more socially aware and tech-savvy tend to value innovation and sustainability, contributing to their strong motivation and willingness to adopt new practices in their classrooms.

Despite these strengths, this study also identified moderate levels of readiness in areas such as pedagogical content knowledge, project-based learning methods, assessment and evaluation, and professional practices. These moderate scores may be attributed to limited practical exposure and experience. For instance, pedagogical content knowledge often develops through consistent teaching practice and mentorship, which pre-service teachers may not have fully experienced yet. Similarly, implementing project-based learning requires high-level planning, classroom facilitation, and assessment skills areas that are complex and often underdeveloped in the early stages of teacher training.

The moderate perception of assessment and professional practices also suggests that while foundational knowledge may be present, the application of these concepts in real teaching environments is still a challenge. This could be due to a predominant reliance on traditional assessments during training and a lack of exposure to diverse or authentic assessment strategies. Additionally, professional practices such as classroom management, ethical decision-making, and collaboration are competencies that typically evolve over time through repeated exposure and real-world teaching experience. Therefore, it is essential for teacher education programs to provide more experiential and practicum-based learning opportunities to bridge the gap between theory and practice, ultimately equipping pre-service teachers to implement effective and sustainable teaching strategies.

CONCLUSION

Based on this preliminary study, researchers can predict that all the factors used in this instrument are able to have a positive or negative impact on the intention of integrating Education for Sustainability Development among pre-service teachers only. This is because these factors are elements that will be considered before a

curriculum is developed. In this regard, it is in line with the Asia-Pacific ESD Teacher Competency Framework which serves as a reference and principle for teachers to implement ESD in their learning environment.

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