

# Chapter 3

## Theoretical Foundations of AI and Sustainability in TV

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### ABSTRACT

*Artificial intelligence (AI) and sustainability in technical and vocational education and training (TVET) looks at methods of technology usage to develop educational strategies that progress AI while working toward sustainable development. The analysis of artificial intelligence (AI) in vocational education and training (TVET) examines ethical elements and essential policy requirements for accomplishing effective deployment. Educational practices increasingly under AI control demand immediate ethical solutions to address data privacy problems and avoid algorithmic bias as well as combat inequalities. The current chapter studies successful implementations of AI integration within vocational learning programs together with approaches which preserve ethical criteria. The chapter recommends working together between educators and policymakers together with industry representatives to optimize the potential value of artificial intelligence in vocational education.*

### 1. INTRODUCTION

Some of the development that occurred in the existing decades, especially in the area of AI, has impacted several aspects about education. Given the global sustainability challenges, the integration option of AI into Technical and Vocational Education and Training (TVET) presents itself as a strategic approach to producing a qualified workforce in addressing diverse emergent sustainability issues. Therefore, this chapter discusses practice-related assumptions based on AI and SDD of TVET and their relevance for further development of academic spaces and work application (Rashid & Kausik, 2024).

#### 1.1 Background

Artificial Intelligence technologies are transforming how we learn as fast progress moves through AI development. Artificial Intelligence technology offers Technical and Vocational Education and Training programs a chance to boost teaching methods and help students develop skills for a sustainable future

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workforce. Learning institutions need to offer students essential capabilities to understand and address growing worldwide risks including climate change and social disparities (Saraswat, 2024)

TVET helps develop practical skills and abilities needed by our industries. TVET educational models combining AI technology and sustainability concentrate enhance students’ success and develop workers who can apply sustainable practices across multiple sectors.

Our chapter studies AI theory and its TVET applications before showing the necessary role of sustainability in professional training programs. We will study the merge between artificial intelligence technology and sustainability education by identifying possible gains and difficulties ahead.

### 1.1.1 Overview of AI and Sustainability in the Context of TVET

AI has revolutionized education in many ways. TVET Training with Artificial Intelligence helps train workers to master skills required for solving modern global sustainability issues. This chapter examines how using Artificial Intelligence and Situated Design Designs improves both academic facilities and work environments.

Artificial Intelligence systems use robotic platforms which enable computer programs to replicate human behavior. AI helps TVET by generating personalized instruction from student information while offering different learning material options for students. Today's sustainability measures create defensive barriers around the environment and economy to allow future generations to thrive through proper resource usage (Rayhan, 2023).

AI and sustainability together prepare TVET students for the future sustainable world. The implementation of AI can be useful in vocational training education and for this reason, the accreditation authorities should include AI in the training programs to ensure that students design ways of dealing with various sustainability challenges that may occur in different fields like renewable energy, sustainable farming etc (Aggarwal, 2023).

Technical and vocational education training institutions need to train workers in sustainable methods to meet industry requirements for tomorrow. TVET programs ameliorate both effectiveness and sustainability through AI technology which optimizes coffers and supports innovative results.

*Table 1. Applications of AI in TVET for Sustainability*

AI Application	Description	Sustainability Impact
Adaptive Learning Systems	AI-driven platforms that personalize learning experiences based on individual student needs and progress.	Enhances educational outcomes, reducing dropout rates and promoting lifelong learning.
Data Analytics for Resource Management	Tools that analyze data on resource usage (e.g., energy, materials) in training facilities.	Optimizes resource consumption, leading to reduced waste and lower environmental impact.
Virtual Simulations	AI-powered simulations that provide hands-on training in sustainable practices (e.g., renewable energy systems).	Prepares students for real-world applications, promoting skills in sustainable technologies.
Intelligent Tutoring Systems	AI systems that provide personalized feedback and guidance to students in technical subjects.	Improves understanding of sustainability concepts and practices among learners.
Predictive Maintenance	AI algorithms that predict equipment failures in training environments, allowing for timely maintenance.	Reduces downtime and resource waste, contributing to more sustainable operations.

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