Driving Educational Transformation: The Synergy of Technology with National and Global Educational Agendas

Mohd Afendi Rojan., Hafizawati Zakaria., A. Syayuthi Abdul Rahman

Faculty of Mechanical Engineering & Technology, Pauh Putra Campus, Universiti Malaysia Perlis, 02600 Pauh, Perlis, Malaysia

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ABSTRACT

Traditional teaching and learning (T&L) methods, which are predominantly passive and teacher-centered, are often faced with significant limitations. This article highlights the role of technology as a catalyst for change, supporting the Malaysian National Education Philosophy (NEP), the principles outlined in the Malaysian Qualifications Framework Second Edition (MQF 2024) and the UNESCO Education for Sustainable Development (ESD) agenda. By integrating technologies such as interactive learning platforms (Moodle + H5P), 3D visualization, artificial intelligence (AI) video, and immersive learning, T&L can be transformed into a more dynamic, interactive, and relevant process. The article also emphasizes how this approach overcomes the weaknesses of traditional T&L and fulfills national and global educational objectives, including the challenges that must be addressed.

Keywords: teaching, interactive learning, technology, education, SDG

INTRODUCTION

Traditional teaching and learning (T&L) methods, which are predominantly teacher-centered and use a one-way approach, are often faced with significant limitations. These weaknesses have become more pronounced in the digital era, where technology is now an integral part of daily life. However, the rate of technology adoption and integration in education varies widely across the globe.

Globally, the rate of technology adoption in education has surged, particularly following the COVID-19 pandemic, with global spending on educational technology projected to reach hundreds of billions of dollars in the coming years. In Malaysia, despite an increase in usage, the rate of technology adoption still shows variation. Although digital infrastructure has been improved, reports indicate that a digital divide persists, especially between urban and rural areas. For instance, while a high percentage of Malaysian higher education institutions utilize learning management systems (LMS) like Moodle, the use of advanced interactive tools such as virtual reality (VR) and augmented reality (AR) remains in its early stages compared to developed countries like South Korea or the United States. This gap necessitates strategic measures to align T&L in Malaysia with global standards and the demands of the 21st century.

This paper presents a strategic framework for integrating key technologies to overcome the limitations of traditional T&L and align with national and global educational goals, while also providing a critical analysis of the challenges to successful implementation.

Research Approach

This article is a conceptual paper and a strategic literature review to synthesize existing knowledge and create a cohesive framework that links technology between NEP, the MQF 2024 and UNESCO's ESD agenda. This approach does not present new empirical data but rather provides a theoretical foundation and a strategic roadmap for technology integration, a perspective not previously explored in a single, comprehensive study. The paper's contribution lies in its synthesis of national and global educational agendas to guide future research and implementation.

National Educational philosophy and direction

The NEP serves as the cornerstone of Malaysia's education system. NEP aims to "produce individuals who are intellectually, spiritually, emotionally, and physically balanced and harmonious," in addition to being "knowledgeable, skilled, of high moral standards, responsible, and capable of achieving personal well-being." This goal aligns with UNESCO's ESD, which emphasizes inclusive and equitable quality education and promotes lifelong learning. According to UNESCO, ESD empowers learners to make informed decisions and act responsibly for environmental integrity, economic viability, and a just society [1]. Both agendas require innovative T&L approaches to holistically develop individual potential [2].

Furthermore, the MQF 2024 reinforces this agenda with new emphasis on three key priorities for modern education: enhancing moral and ethical values through Values-Based Education (VBE), embedding sustainability skills and knowledge via a Global Sustainability Agenda (GSA), and creating more adaptable educational journeys through Flexible Learning Pathways (FLP). Therefore, contemporary T&L must move beyond rote memorization and exam-based education towards focusing on producing holistic, competitive, and responsible individuals prepared to address global issues via student-centered learning.

Traditional T&L Limitations And Technological Solutions

The limitations of traditional T&L in providing real-world, practical experience are a major weakness. Experiential learning theory, championed by David Kolb, suggests that learning is a process where knowledge is created through the transformation of experience [3]. It is a continuous process that moves through a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. The strategic use of technology not only addresses the weaknesses of traditional T&L but also directly helps achieve the objectives of the NEP and Sustainable Development Goals (SDG).

A. Passive Learning versus Interactive Learning

The passivity of traditional T&L can be overcome with interactive learning. The integration of tools like H5P into the learning management system (LMS) platform (e.g. Moodle) allows educators to create engaging activities such as interactive videos and picture quizzes. This approach fosters an active, student-centered learning environment, aligning with the NEP's goal of producing skilled and knowledgeable individuals. Through meaningful interaction, students not only absorb information but also develop collaboration and communication skills, which are crucial for the balanced personal development envisioned by the NEP. Research indicates that integrating interactive tools in Moodle significantly boosts student engagement and learning outcomes [4].

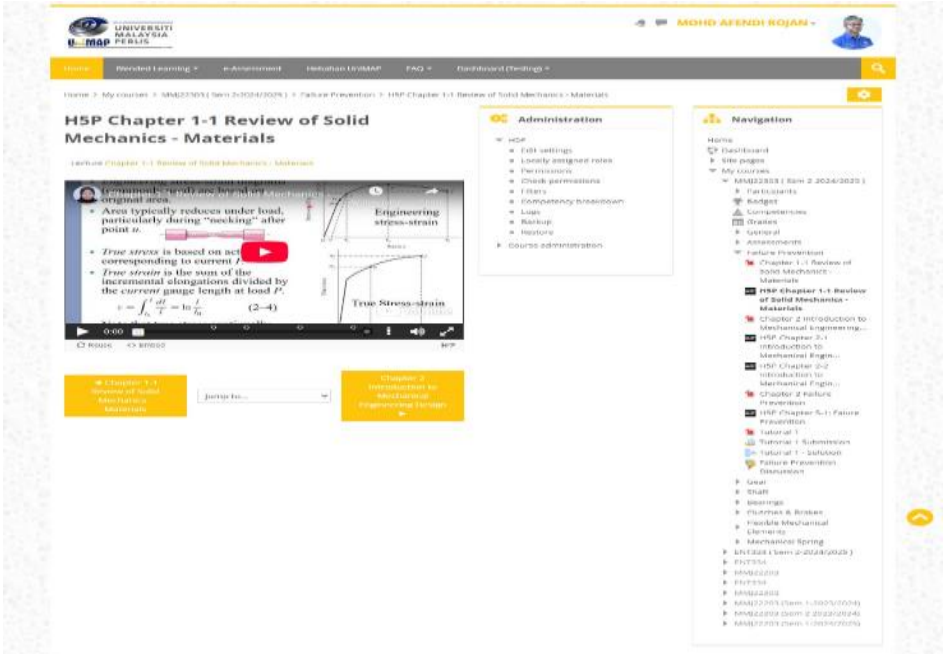

Fig. 1 Example of H5P Interactive Content Adaptation in Moodle at Universiti Malaysia Perlis

B. 3D Visualization for Deeper Understanding

To address the visualization constraints of traditional T&L, 3D animation provides an effective solution. This technology allows students to visualize abstract concepts more realistically, supporting intellectual development and spatial comprehension. Figure 2 illustrates a conceptual model of 3D visualization in education. This approach moves beyond the confines of traditional 2D representations to unlock a more profound understanding. This technology, which includes interactive 3D models and augmented/virtual reality simulations, allows students to manipulate, explore, and interact with virtual objects as if they were real.

The implementation of 3D visualization leads to three key outcomes: enhanced spatial comprehension, allowing students to better understand how components fit together; increased student engagement, as the interactive nature of the content boosts motivation and retention; and a deeper understanding of complex concepts, as students can visualize and experiment with abstract ideas in a concrete way. This approach directly aligns with the objectives of SDG 4 (Quality Education) by making subjects like Science, Technology, Engineering, and Mathematics (STEM) more accessible and effective for diverse learning styles. Studies have confirmed that using 3D models in subjects like anatomy education significantly enhances students' understanding compared to traditional methods. A study found that using 3D models in anatomy education enhances students' understanding [5].

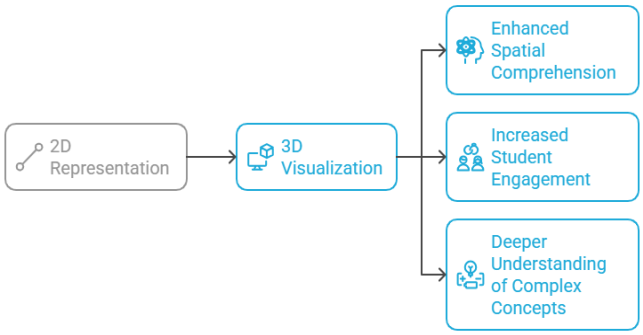

Fig. 2 A Conceptual Model of 3D Visualization in Education.

C. AI Video: Producing Content Quickly and Efficiently

The time-consuming process of creating instructional materials in traditional T&L can be resolved with AI video. This tool allows educators to quickly convert text into video. This frees up educators' time to focus on student guidance and interaction, thereby strengthening the spiritual, emotional, and social aspects of students. AI video also accelerates the creation of quality learning materials, enabling educational content to be disseminated more widely and equitably.

Figure 3 depicts the process flow for the AI video creation for educators. The process is streamlined into three key steps. First, the educator inputs a text script, which can be derived from existing lecture notes or research papers. In the second step, the AI engine autonomously generates visuals, including animations, images, and characters, and produces a professional voiceover. This automates the most time-intensive aspects of video production. Finally, the educator can review and refine the output, making minor adjustments to ensure accuracy and alignment with pedagogical goals. AI video generation tool can be utilized as a powerful solution to the time-consuming process of creating instructional videos in traditional education. This type of tool simplifies video production, allowing educators to focus on content quality rather than technical details.

D. Immersive Learning: Bringing Experiences to Life

The lack of practical experience in traditional T&L can be remedied with immersive learning using VR and AR. These experiences are not only engaging but also create emotional and sensory involvement, which is essential for developing responsible and capable students. Immersive learning is highly relevant for achieving SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action), as students can participate in simulations to understand the impacts of climate change or design sustainable cities in a safe, virtual

environment. A study confirms that immersive learning can boost student motivation, engagement, and information retention [6]. A literature review also suggests that the metaverse, as an immersive learning environment, opens a new dimension in higher education by offering more interactive and engaging environments, in line with the needs of the Industrial Revolution 4.0 (IR 4.0) [7]. Figure 4 illustrates the application of VR in an immersive learning environment, a technology that addresses the limitations of traditional T&L by providing dynamic, experiential learning opportunities. Based on insights from the augmented and virtual reality in education market, VR is transforming education by offering students a powerful sense of presence in a simulated world.

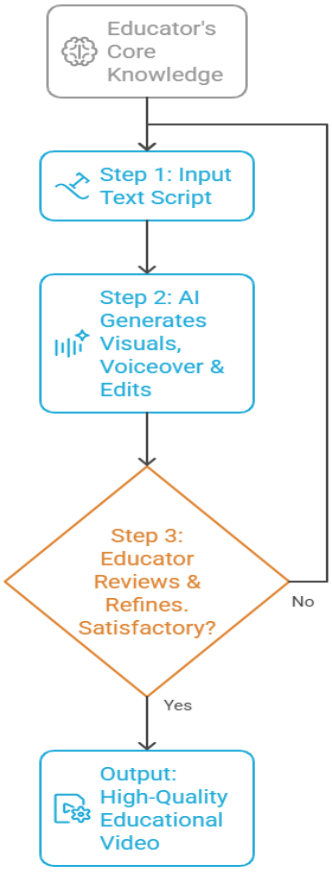

Fig. 3 The 3D AI Video Creation Process for Educators

Best Practices OF Experiential And Immersive T&L: Global And Local Perspectives

To complement the discussion on technology's potential, it's crucial to examine best practices that have been successfully implemented globally and locally. These examples demonstrate how the smart integration of technology can stimulate student interaction, enhance engagement, and achieve superior learning outcomes.

A. Global Best Practices

1. Gamification with Learning Platforms: Universities like Stanford University and the Massachusetts Institute of Technology (MIT) have utilized gamification in their online courses. Platforms such as Coursera and edX incorporate badges, points, and leaderboards to motivate students to complete assignments and engage in healthy competition. This approach aligns with research indicating that gamification can boost intrinsic motivation and student participation [8].

2. Problem-Based Learning (PBL) and Virtual Simulations: Leading educational institutions in Europe frequently use digital simulations for T&L. For example, engineering students at ETH Zurich use VR simulations to design and test prototypes virtually before building physical models. This method, also known as PBL, provides in-depth practical experience and cultivates critical thinking skills.

3. Hybrid Learning and Flipped Classrooms: The flipped classroom model, where students learn theoretical content at home via videos or readings and use class time for discussions, projects, and interactive activities, has become a common practice in many international institutions. This approach, integrated with platforms like Moodle and interactive tools, maximizes in-class interaction.

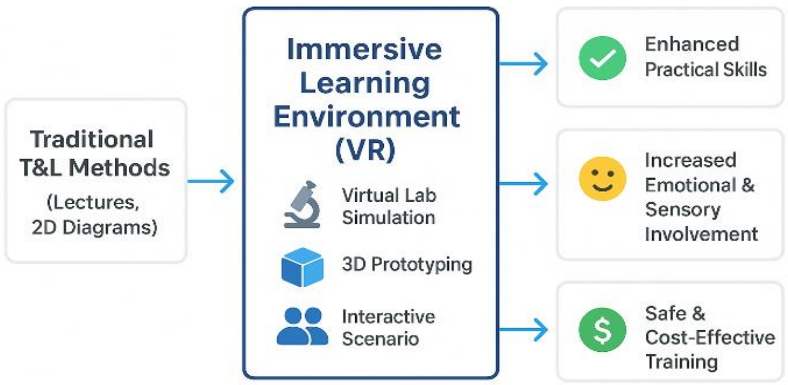

Fig. 4 VR Usage in an Immersive Learning Environment

B. Best Practices in Malaysia

1. 'Educational Metaverse' Initiatives in Higher Education: Several local universities are exploring the potential of the metaverse for immersive learning. A study by Liew and Kamrozzaman proposed a metaverse T&L model for the National Language A course in higher education institutions [9]. This model leverages an interactive 3D environment to improve students' communication and cultural skills, thus overcoming the limitations of traditional learning.

2. Use of AR/VR in Vocational Training: In the Technical and Vocational Education and Training (TVET) sector, AR/VR technology is increasingly used for practical simulations [10]. Students can practice technical skills like engine repair or operating dangerous machinery in a safe, virtual environment. This practice not only enhances safety but also saves costs and resources.

Challenges and Strategic Considerations for Implementation

While the integration of technology offers a powerful pathway to educational transformation, its widespread and equitable implementation in Malaysia faces several significant challenges. These barriers must be addressed strategically to ensure that all stakeholders benefit from the digital shift.

A. The Persistence of the Digital Divide

Despite improvements in digital infrastructure, a notable digital divide persists especially between urban and rural areas. This disparity extends beyond hardware access to include reliable internet connectivity and digital literacy. For example, broadband penetration in rural Malaysian regions is significantly lower than in urban centers, highlighting unequal internet access across the country [11]. Moreover, students from lower socioeconomic backgrounds (B40 group) face distinct barriers in digital technology usage in higher education institutions [12]. Without addressing these fundamental gaps, the full benefits of advanced technologies cannot be realized. Efforts such as equitable distribution of devices, improved connectivity, and digital literacy programs are critical for inclusive quality education.

B. Financial Barriers and Cost-Effectiveness

Implementing advanced educational technologies such as VR and AR requires substantial financial investment, including initial acquisition, ongoing maintenance, licensing, and technical support. In Malaysia, the AR/VR education market faces notable resource constraints: costs of devices, lack of trained educators and content developers, infrastructure limitations, and data privacy concerns [13]. In higher education, institutions like

Monash University Malaysia and Universiti Teknologi Malaysia (UTM) have begun exploring VR applications in architecture and engineering, but widespread adoption remains limited due to high costs and lack of technical training [10]. Strategic solutions should include leveraging open-source platforms (e.g., Moodle with H5P), pursuing institutional and governmental funding, and forming partnerships with technology providers to enable scalable, cost-effective implementations.

C. The Need for Continuous Training and Professional Development

Technology is only as effective as the educators who wield it. A significant barrier lies in the necessity for ongoing training to equip educators with both the technical and pedagogical competencies required for meaningful integration. Research indicates that Malaysian teachers often lack practical ICT skills and adequate training during pre-service education [14]. Furthermore, a UNESCO study found that while 56% of teachers had received some training to teach online, many lacked the capacity to meaningfully implement technology for learning [15]. In computational thinking, a large proportion of instructors remain unclear about what the concept entails, even after undergoing training sessions [16]. To mitigate these challenges, institutions must invest in professional development that addresses not only technical tools but also innovative teaching methods, emphasizing student-centered learning, critical thinking, creativity, and emotional and spiritual development in line with NEP goals.

CONCLUSIONS

The use of technology in T&L is not merely a trend but a strategic necessity for driving educational transformation. By wisely integrating technologies such as interactive platforms, 3D visualization, AI video, and immersive learning, we can overcome the weaknesses of traditional, passive T&L methods and move toward more dynamic and student-centered approaches. This is fundamentally supported by educational theories, as these technologies directly enable the core tenets of constructivism, connectivism, and experiential learning. The strategic implementation of these technologies serves as a key enabler for achieving the grand goals set forth in the NEP, the MQF 2024, and UNESCO's ESD agenda.

Technology provides flexible and innovative tools for producing a generation that is not only knowledgeable but also intellectually, spiritually, and emotionally balanced. However, as explored in this paper, the successful and equitable integration of these technologies is not without its challenges. The persistence of the digital divide, significant financial barriers, and the critical need for continuous professional development for educators must be addressed holistically. It is our collective responsibility to produce a generation that is not only knowledgeable but also ready to contribute to national prosperity and global sustainability. This paper's synthesis of national and global educational agendas with practical technological solutions provides a crucial strategic roadmap for future research and implementation, ensuring that educational transformation benefits all.

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