International Journal of Engineering Trends and Technology
ISSN: 2231–5381 / https://doi.org/10.14445/22315381/IJETT-V73I1P109

Volume 73 Issue 1, 104-119, January 2025

Original Article

Advances in Educational Technologies Shaping the Future: A Scopic Review and Survey Analysis to Determinant of TVET Foundation Program Choice

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Received: 16 September 2024 Revised: 08 November 2024 Accepted: 07 December 2024 Published: 31 January 2025

Abstract *- The rapid advancement of technology is significantly altering educational paradigms, presenting both opportunities and challenges for educational institutions. The integration of emerging technologies into educational settings requires careful consideration to ensure they enhance learning experiences and outcomes. This paper aims to explore recent trends and advancements in emerging technologies that are influencing the future of education. It seeks to identify how these technologies can be effectively integrated into educational settings to improve teaching and learning experiences. The methodology employed in this study is meticulously designed to ensure a thorough and unbiased analysis, using Creative Research Systems to determine the appropriate sample size for the study. The literature search was conducted using a combination of 10 relevant keywords across multiple academic databases, including Google Scholar, ScienceDirect, Scopus, PubMed, and IEEE Xplore. The initial search yielded a total of 1,500 papers from 2019 to 2024. These were then screened to ensure relevance and quality, resulting in the collection of 304 papers for further review. From these, 86 were selected for detailed analysis. For the survey, 162 sets of questions were distributed, and 149 were retrieved, with a 92% response rate. The survey found that 49.0% of respondents chose the TVET foundation program for career opportunities, 40.9% due to interest in the field, 5.4% were influenced by parental choice, 3.4% for other reasons, and 1.3% had no other options. The study identifies key trends such as AI-driven intelligent tutoring systems for personalized learning, immersive AR and VR environments, gamified learning platforms, AI-powered teaching assistants, blockchain for secure credentials, centralized learning resources, and global MOOC accessibility. These technologies promise to enhance learning experiences, boost engagement, and streamline educational processes. It concludes that career opportunities and personal interest are the primary drivers for students choosing the TVET foundation program, with parental influence and other factors playing minor roles. The integration of these technologies into education is seen as pivotal for preparing students for future challenges, including investment in technology, fostering accessible platforms, promoting personalized learning approaches, and continuous research. Embracing these advancements is essential to maintaining the relevance, inclusivity, and impact of education in the 21st century.*

Keywords *- AI in education, Educational platforms, Emerging technologies, Immersive learning, Personalized learning.*

1. Introduction

In Malaysia, the Technical and Vocational Education and Training (TVET) Foundation Program serves as a critical pathway for students seeking specialized skills and career opportunities [1]. The program's design aims to provide practical training and knowledge tailored to various industries, making it a popular choice for those interested in vocational and technical careers [2]. Understanding the factors that influence students' decisions to enrol in TVET programs is essential for aligning educational offerings with market needs and enhancing program attractiveness [2]. Determinants of TVET Foundation Program choice encompass a range of influences, including career prospects, personal interests, and external guidance from family [2]. Career opportunities are a major driving force as students seek programs that promise strong employment outcomes. Personal interest in specific technical fields also plays a significant role, reflecting students' intrinsic motivation [2]. Additionally, parental influence and other individual factors contribute to the decision-making process, highlighting the diverse considerations that shape students' educational choices [3]. The rapid evolution of technology in recent years has

profoundly impacted various sectors, with education being one of the most significantly transformed fields [4]. From 2020 to 2024, a myriad of emerging technologies and advances have reshaped educational settings, driving a paradigm shift in how education is delivered, accessed, and experienced [5]. This period has seen an unprecedented acceleration in the adoption of digital tools and platforms, catalyzed by the global COVID-19 pandemic, which necessitated a swift transition to remote and hybrid learning models [6]. Consequently, the integration of advanced technologies in education has not only enhanced learning experiences but also democratized access to quality education across the globe [6,7,8].

One of the most notable trends is the proliferation of Artificial Intelligence (AI) and Machine Learning (ML) in educational technologies. AI-driven tools have revolutionized personalized learning, enabling educators to tailor educational experiences to individual student needs [9]. For instance, intelligent tutoring systems leverage AI to provide real-time feedback and adaptive learning paths, fostering a more individualized and effective learning process [10]. Moreover, AI-powered analytics tools help educators identify at-risk students and devise timely interventions, thereby improving student retention and success rates [11].

The advent of immersive technologies, such as Virtual Reality (VR) and Augmented Reality (AR), has also marked a significant advancement in educational settings [12]. These technologies offer immersive and interactive learning experiences that enhance student engagement and comprehension. VR and AR applications have been successfully implemented in various educational contexts, from virtual field trips that bring historical events to life to complex simulations in medical and engineering training that provide hands-on practice in a safe, controlled environment [13,14]. Such immersive experiences not only make learning more engaging but also improve retention and understanding of complex concepts [14].

Furthermore, the integration of Internet of Things (IoT) devices in educational environments has facilitated the development of smart classrooms, enhancing the learning experience through real-time data collection and analysis [15-16]. IoT-enabled classrooms provide a seamless and connected learning environment where devices such as smartboards, interactive projectors, and wearable technology work in concert to create an interactive and responsive educational setting [17]. These smart systems enable educators to monitor student engagement and environmental factors, optimizing the learning experience in real time [18].

Blockchain technology has emerged as a transformative force in the realm of educational administration and certification. Blockchain's decentralized and secure nature offers a robust solution for credentialing, ensuring the integrity and verifiability of academic records and certificates [19]. This technology addresses issues of fraud and tampering, providing a trustworthy system for verifying educational achievements [20]. Additionally, blockchain facilitates the creation of lifelong learning passports, allowing individuals to maintain and share their academic and professional accomplishments seamlessly across borders [20]. For instance, blockchain initiatives like the European Blockchain Services Infrastructure (EBSI) and platforms like Learning Machine have been successfully used to issue tamper-proof digital diplomas, allowing employers to verify qualifications instantly. In the TVET context, implementing blockchain could streamline credential verification, reduce fraud, and provide students with easily accessible, lifelong records of their skills and certifications, thus enhancing their employability in the global job market [20].

The increasing reliance on cloud computing has further revolutionized educational practices by providing scalable and cost-effective solutions for data storage and management [21]. Cloud-based platforms have enabled educational institutions to offer flexible learning solutions, such as Massive Open Online Courses (MOOCs) and virtual classrooms, which cater to a diverse and global student population [22]. These platforms support collaborative learning and resource sharing, breaking down geographical and temporal barriers to education [23].

The period from 2020 to 2024 has witnessed remarkable advancements in educational technologies, driven by rapid developments in AI, VR/AR, IoT, blockchain, and cloud computing. These technologies have collectively redefined the landscape of education, making it more accessible, personalized, and engaging [24-26]. This paper aims to provide a comprehensive review of these emerging trends and advances, exploring their implications and potential to shape the future of educational settings. With the view of examining the intersection of technology and education, the understanding of how these innovations are paving the way for a more dynamic and inclusive educational environment can be improved.

First, existing research provides valuable insights into the current state and future directions of TVET, especially in Southeast Asia. For instance, [1] offers a comprehensive overview of TVET in Malaysia, addressing the current status and future development of vocational education in ASEAN member states. However, this study primarily focuses on regional analysis, and while it mentions technological advancements, it does not delve deeply into the implications of educational technologies on TVET program choices, which is the core area of this research. In contrast, the current study aims to examine how advances in educational technologies are shaping the decision-making process for TVET foundation program choices, considering variables such as accessibility, technology adoption, and digital literacy.

Further, while studies like those by [2] explore how career guidance influences the development of technical skills among graduates, they do not explicitly address the role of educational technologies in the context of TVET. The present study seeks to bridge this gap by investigating the impact of educational technologies on students' career choices in TVET, thereby extending the work of [2] into the digital realm. In addition, while [3] investigates decision-making factors in the context of international education, their work is primarily concerned with parental influence in the decision-making process, which differs from the focus of the present research on how technological advancements influence students' decisions regarding TVET foundation programs. The novelty of this study lies in its exploration of how technological factors such as AI, personalized learning systems, and digital platforms can shape the future of vocational education choices, a theme that is not directly addressed in the existing literature. Moreover, research on intelligent tutoring systems, such as those presented by [6], contributes to the field of educational technology by demonstrating how personalized learning can enhance educational experiences. However, these studies focus on the broader use of intelligent tutoring systems and AI in learning environments, without specific emphasis on TVET or the factors influencing students' program choices. Drawing on this literature, the current study introduces the specific context of TVET, providing a new perspective on how adaptive learning systems and intelligent tutoring platforms can influence students' decisions in vocational education.

2. Literature Review

Table 1 shows the systematic literature reviews regarding TVET. It provides a comprehensive overview of the integration and impact of emerging technologies, particularly AI and Machine Learning, in the educational sector. It highlights a trend towards personalized learning and intelligent tutoring systems, indicating that these technologies are gaining traction in creating individualized learning paths and offering real-time feedback to students. The table also identifies leading institutions like Stanford University in the USA as pioneers in adopting these technologies, reflecting a global trend towards integrating advanced technology in education. The literature based on Table 1 suggests a promising future for these technologies, with high applicability across educational contexts. However, challenges such as data privacy, cost, and accessibility are noted, with potential solutions like robust data protection measures and scalable implementations being recommended. Overall, the literature conveys that while the potential of these technologies is significant, addressing the associated challenges is crucial for their successful and widespread adoption in the future of education.

Table 1. Systematic review table

Trends	Authors	Emerging Technologies and Advances	Decision for Education Future		Aspect of Education	General Applicability of Technology			Solution	University in the use of Technology	Country
			Yes	No		Low	Medium	High			
AI and Machine Learning	[6-14, 77]	Personalized Learning, Intelligent Tutoring Systems			Individualized learning paths, real-time feedback				Robust data protection measures, scalable solutions	Stanford University	USA
VR and AR	[15-27]	Immersive Learning Experiences			Enhanced engagement, improved retention				Subsidized devices, inclusive design	University of Cambridge	UK
IoT	[28-40]	Smart Classrooms			Real-time monitoring, interactive learning	*			Enhanced security protocols, user training	Seoul National University	South Korea
Blockchain	[41-48]	Secure Credentialing, Academic Records			Integrity and verifiability of credentials		*		Standardized frameworks, policy development	MIT	USA
Cloud Computing	[49-55]	MOOCs, Virtual Classrooms			Flexible learning solutions, global access	*			Improved cybersecurity measures, offline access	University of Tokyo	Japan

									options		
5G Technology	[56-65]	High-speed Internet Access			Enhanced connectivity for online learning				Government and private sector partnerships for infrastructure development	University of California, Berkeley	USA
Big Data Analytics	[66-68]	Data-Driven Decision Making			Curriculum development, student performance tracking	*			Advanced data management tools, strict privacy regulations	University of Melbourne	Australia
Gamification	[69-72]	Game-based Learning Platforms			Student engagement, motivation				Regular updates, cost-effective solutions	University of Edinburgh	UK
Robotics	[73][6]	Automated Teaching Assistants			Support for repetitive tasks, interactive learning				Cost-sharing models, robust maintenance programs	National University of Singapore	Singapore
Natural Language Processing (NLP)	[74-76]	Automated Grading Systems			Efficiency in assessment, consistent grading				Continuous improvement of algorithms and the inclusion of diverse datasets.	University of Oxford	UK
Augmented Analytics	[66-68]	Enhanced Data Interpretation			Improved decision-making, real-time insights	*			Simplified integration processes and cost-effective tools.	University of Toronto	Canada
Quantum Computing	[69-72]	Advanced Computational Capabilities			Complex problem-solving, research capabilities				Ongoing research and development, international collaboration.	Tsinghua University	China
Smart Learning Environments	[66-68]	Interactive Learning Spaces			Collaboration, engagement				Technical support, funding.	University of Barcelona	Spain
Learning Management Systems (LMS)	[69-72]	Centralized Learning Platforms			Course management, student tracking				User training and integration support.	University of Manchester	UK
e-Assessment Tools	[74-76]	Online Testing Platforms			Assessment, feedback				Proctoring tools technical support.	University of Cape Town	South Africa
Social Media Integration	[66-68]	Collaborative Learning Platforms			Peer interaction, knowledge sharing				Privacy settings, guided use.	Seoul National University	South Korea

Augmented Reality (AR)	[69-72]	Interactive Educational Content			Enhanced engagement, practical training				Cost-effective solutions, inclusive design.	University of California, Berkeley	USA
Learning Analytics	[66-68]	Data-Driven Insights			Student performance tracking, curriculum development	*			Privacy measures and user-friendly tools.	University of Toronto	Canada
Mobile Learning	[69-72]	Learning via Mobile Devices			Flexibility, accessibility	*			Optimized content, guided use.	University of California, Berkeley	USA
Chatbots	[69, 37, 72]	Student Support Systems			Assistance, engagement	*			Improved algorithms and user training.	National University of Singapore	Singapore
Adaptive Testing	[73, 52]	Personalized Assessment			Student evaluation, learning paths				Scalable solutions, teacher training.	Harvard University	USA

3. Materials and Methods

This paper presents a scoping systematic review and survey analysis of the determinants of TVET program choice, which was conducted to comprehensively map and evaluate the existing literature on various educational technologies. The methodology employed in this study is meticulously designed to ensure a thorough and unbiased analysis, using Creative Research Systems to determine the appropriate sample size for the study.

3.1. Search Strategy and Data Collection

The literature search was conducted using a combination of relevant keywords across multiple academic databases, including Google Scholar, ScienceDirect, Scopus, PubMed, and IEEE Xplore. The keywords were tailored to capture a broad range of studies within specific themes such as "Personalized Learning, Intelligent Tutoring Systems," "Immersive Learning Experiences," "Smart Classrooms," "Secure Credentialing, Academic Records," "MOOCs, Virtual Classrooms," "Game-based Learning Platforms," "Automated Teaching Assistants," "Automated Grading Systems," "Advanced Computational Capabilities," and "Centralized Learning Platforms." The total number of search results obtained for each theme was recorded.

3.2. Screening and Selection

The initial search yielded a total of 1,500 papers. These were then screened to ensure relevance and quality, resulting in the collection of 304 papers for further review. The screening process involved a detailed examination of titles, abstracts, and, where necessary, full texts to determine the suitability of each paper for inclusion in the study. This rigorous screening process ensured that only the most pertinent and high-quality papers were selected.

3.3. Data Extraction and Analysis

Of the 304 papers that were collected, 89 were selected for detailed analysis. Data extraction was performed systematically, recording the number of papers downloaded and their distribution across different publication types (conference papers, journal articles, magazine articles, and books). For each theme, the proportion of papers downloaded to the total search results was calculated, along with the proportion of papers across the various publication types.

3.4. Proportions Calculation

The proportions of the papers downloaded relative to the total search results and the proportions of papers in conferences, journals, magazines, and books. The analysis provided a detailed overview of the distribution and proportion of research papers across different publication formats. The findings were reported in tabular form, summarizing the number of search results, papers downloaded, and their respective proportions across various publication types for each theme.

This methodological approach ensures a comprehensive and systematic review of the literature, highlighting key trends and providing valuable insights into the landscape of educational technology research. The rigorous selection and analysis process underscores the credibility and reliability of the findings, contributing to the broader understanding of advancements and research focus in the field of educational technologies.

3.5. Sample Size

The mathematical formula commonly used for calculating sample size based on Creative Research Systems a known population size, confidence level, and margin of error

is derived from the formula for calculating the sample size for a proportion:

$$n = \frac{N.Z^2.p\,(1-p)}{(N-1).E^2 + Z^2.p\,(1-p)}$$

Where:

- n = required sample size
- N = population size (total number of papers, in your case 1500)
- Z = Z-score corresponding to the desired confidence level (typically for 95% confidence, Z≈1.96Z \approx 1.96Z≈1.96)
- p = estimated proportion (if unknown, use p=0.5p = 0.5p=0.5 for maximum variability)
- E = margin of error (expressed as a proportion, e.g., 0.05 for 5% margin of error)

For the survey, the sample size of 162 was used as the population is 280, following the rules of thumb of Krejcie and morgan sample table of 1970. Out of these 162, 149 are screened and confirmed valid for analysis. The literature review search components in Table 2 present an overview of various studies on educational technologies, categorized by search keywords, results, and different publication formats. Each row in the table represents a set of studies grouped by specific keywords, detailing the number of search results, the number of papers downloaded, and the breakdown of these papers across conferences, journals, magazines, and books. Additionally, the table includes calculated proportions to provide insights into the distribution of papers among different publication types. The first set of studies [27, 28] focused on "Personalized Learning, Intelligent Tutoring Systems," resulting in 110 search results, from which 14 papers were downloaded. These papers were predominantly presented at conferences (84), followed by journals (25), magazines (1), and no books. The proportions indicate that 12.7% of the search results were downloaded, with 16.7% of the downloaded papers presented at conferences, 56% in journals, and 14 times as many in magazines compared to the papers downloaded. The second set [27, 28, 29] explored "Immersive Learning Experiences," yielding 1,677 search results with 10 papers downloaded.

Table 2. Literature collection

Author/year of publications	Keywords of search	Result of search	No. Of papers downloaded	Conference	Journal	Magazine	Books	Proportion of no of paper downloaded to result of search	Proportion of papers downloaded to conference	Proportion of papers downloaded to journal	Proportion of papers downloaded to magazines and books
[1-14]	Personalized Learning, Intelligent Tutoring Systems	110	14	84	25	1	0	0.127	0.167	0.56	14
[15-27]	Immersive Learning Experiences	1677	10	1297	281	57	24	0.006	0.008	0.036	0.12
[28-38]	Smart Classrooms	720	8	681	33	4	1	0.011	0.012	0.242	1.6
[39-47]	Secure Credentialing, Academic Records	23	9	21	1	0	1	0.391	0.429	9	9
[48-55]	MOOCs, Virtual Classrooms	98	8	85	8	0	1	0.082	0.094	1	8
[56-65]	Game-based Learning Platforms	127	10	102	23	0	0	0.079	0.098	0.435	0
[62,66-68]	Automated Teaching Assistants	37	3	37	0	0	0	0.081	0.081	0	0
[69-72]	Automated Grading Systems	514	4	414	91	4	0	0.008	0.01	0.044	1
[73]	Advanced Computational Capabilities	2432	1	1355	939	55	12	0.001	0.001	0.001	0.015
[74-76]	Centralized Learning Platforms	462	3	300	127	17	2	0.007	0.01	0.024	0.158

The downloaded papers were mostly found in conferences (1,297), journals (281), magazines (57), and books (24). Here, only 0.6% of the search results were downloaded, with a proportion of 0.8% in conferences, 3.6% in journals, and 12% in magazines and books. For "Smart Classrooms" [30, 31], the search returned 720 results, from which 8 papers were downloaded. These papers were distributed across conferences (681), journals (33), magazines (4), and books (1). The proportion of downloaded papers to search results was 1.1%, with 1.2% in conferences, 24.2% in journals, and 160% in magazines and books. The "Secure Credentialing, Academic Records" [31, 32] search resulted in 23 hits, with 9 papers downloaded. These were mainly from conferences (21) and journals (1), with no entries in magazines but 1 in books. The download proportion was relatively high at 39.1%, with 42.9% in conferences and a significant 900% in journals and books.

Studies on "MOOCs, Virtual Classrooms" [33, 34, 35] generated 98 search results, from which 8 papers were downloaded. These papers were found in conferences (85), journals (8), and books (1), with none in magazines. The proportion of downloads to search results was 8.2%, with 9.4% in conferences, 100% in journals, and 800% in books. The words "Game-based Learning Platforms" [36, 37] yielded 127 search results, with 10 papers downloaded. These papers were published in conferences (102) and journals (23), with no entries in magazines or books. The proportion of downloads to search results was 7.9%, with 9.8% in conferences and 43.5% in journals. "Automated Teaching Assistants" [38, 39] had 37 searches, with none in books. The download proportion was 0.8%, with 1% in conferences, 4.4% in journals, and 100% in magazines. The search on "Advanced Computational Capabilities" [41] returned 2,432 results, with only 1 paper downloaded. This paper was from a conference (1,355), journals (939), magazines (55), and books (12).

The proportion of downloads was extremely low at 0.04%, with 0.1% in conferences, 0.1% in journals, and 1.5% in magazines and books. Finally, "Centralized Learning Platforms" [42] had 462 search results, with 3 papers downloaded. These were presented in conferences (300), journals (127), magazines (17), and books (2). The download proportion was 0.7%, with 1% in conferences, 2.4% in journals, and 15.8% in magazines and books results, with 3 papers downloaded, all presented at conferences. The proportion of downloads to search results was 8.1%, with an equal proportion in conferences and no entries in journals, magazines, or books. For "Automated Grading Systems" [40, 41], the search resulted in 514 hits, with 4 papers downloaded. These papers were distributed across conferences (414), journals (91), and magazines (4), popular among researchers, particularly in fields related to engineering, technology, and computer science. Table 3 presents the report of literature analysis of the number and percentage of papers published over a five-year period from 2020 to 2024. The data highlights the trends and distribution of publications each year, providing insights into the research output over time. In 2020, a total of 10 papers were published, accounting for 13.2% of the total publications over the five-year period. This year marked the starting point of the analysis, with a modest number of papers being produced.

Based on Table 3, in 2021, a significant increase in the number of papers, with 24 publications. This represents 31.6% of the total, indicating a peak in research activity. The notable rise in publications could be attributed to heightened research efforts or increased funding and interest in the subject matter during this period. In 2022, the number of published papers slightly decreased to 18, making up 23.7% of the total.

Although there was a drop from the previous year, the output remained relatively high, suggesting sustained interest and ongoing research efforts. The year 2023 witnessed a slight increase in publications compared to 2022, with 20 papers being published. This accounted for 26.3% of the total, reflecting a steady continuation of research activities. The consistency in output over these two years demonstrates a stable commitment to the research field. Finally, in 2024, there was a noticeable decline in the number of publications, with only 4 papers published, constituting 5.2% of the total. This significant drop could be due to various factors such as shifting research priorities, reduced funding, or external influences impacting research productivity. Table 4 shows the paper screening steps for the study. The study details the data administration process for a research study, including the mapping, collection, screening, exclusion, and final usage of research papers. The analysis provides insights into the efficiency and effectiveness of the data management process.

From Table 4, the total number of papers initially mapped for the study was 1,500. This figure represents the complete scope of potential research papers considered at the beginning of the study. Out of these, a subset of 304 papers was collected, which accounts for 100% of the papers selected for further processing.

Table 3. Literature tear of publications

Years	No of papers	Percentage %
2020	10	13.2
2021	24	31.6
2022	18	23.7
2023	20	26.3
2024	4	5.2

Table 4. Paper screening steps

Data admin	Frequency	Percentage (%)
Total paper mapped	1500	-
Total paper collected	304	100%
Screened	89	29.27%
Excluded	228	75.0%
Used	86	25%

The next stage in the process was screening, where 89 papers were retained for further evaluation. This represents 29.27% of the collected papers. The screening process is crucial for ensuring that only relevant and high-quality papers are considered for inclusion in the study. Following the screening, 228 papers were excluded, accounting for 75% of the screened papers. The high exclusion rate reflects the rigorous criteria applied during the screening process to ensure the relevancy and quality of the research materials. Finally, 86 papers were deemed suitable for use in the study, representing 25% of the screened papers. This final selection highlights the thoroughness of the data administration process, ensuring that only the most pertinent and high-quality papers were included in the study. The data administration process demonstrates a meticulous approach to managing research materials. From the initial mapping of 1,500 papers to the final use of 86, the process involved careful selection, screening, and exclusion to ensure the relevance and quality of the research papers included in the study. This comprehensive approach underscores the importance of rigorous data management in conducting high-quality research. The 86 papers are used for detailed analysis.

4. Results and Discussion

The survey for students' choice for TVET foundation program is then conducted based on the literature analysis conducted. Table 5 shows the total number of questionnaires administered for the survey and the total number of questionnaires valid for further analysis to obtain the results for determining the choices of TVET foundation program among the students' preferences. The sample size of 162 administered for the survey comes from the total number of students taking the TVET foundation program for the first batch offered. Since the TVET foundation program is being offered for the first time, it is essential that the study is conducted to obtain the effectiveness of the program offered. Based on Table 5, out of 162 questionnaires administered, 149 were retrieved and screened, representing a response rate of 92%, with all 149 deemed valid for analysis. The gender distribution of the respondents is presented in Table 6. The sample consists of 149 participants, with a significant majority being male. Specifically, 105 respondents, or 70.5%, identified as male, while 44 respondents, accounting for 29.5%, identified as female.

Table 5. Survey Data administration

Questionnaires	Frequency	(%)
The total number of questionnaires administered	162	100%
Screened	149	92%
Valid for analysis	149	92%

Table 6. Demographic information

Gender	Frequency	Percent
Male	105	70.5
Female	44	29.5

Table 7. Race distribution

Race	Frequency	Percent
Malay	117	78.5
Chinese	8	5.4
Indian	18	12.1
Others	6	4.0
Total	149	100.0

Table 8. Field of study during high school

High School Field of study	Frequency	Percent
Pure science	112	75.2
Accounting science	6	4.0
Literature	1	.7
Others	30	20.1
Total	149	100.0

This distribution indicates a higher representation of males within the surveyed population. From Table 7 it reveals the racial composition of the respondents is detailed in the collected data, revealing a diverse array of backgrounds among the participants. Most of the respondents, 117 individuals or 78.5%, identified as Malay. This substantial representation highlights the prominence of the Malay community within the polytechnic institutions surveyed. The Chinese community is represented by 8 respondents, which constitutes 5.4% of the total sample. This smaller yet significant group adds to the racial diversity captured in the study. Indian respondents make up 12.1% of the sample, with 18 individuals identifying as Indian. This group represents the second-largest racial category among the respondents, underscoring the importance of considering their perspectives in the analysis. Lastly, the 'Others' category, which includes 6 respondents or 4.0% of the sample, encompasses various other racial backgrounds. This category, though the smallest, contributes to the overall diversity of the dataset.

The data on the field of study during high school among the respondents is summarized in Table 8. Most of the participants, 112 individuals or 75.2%, reported having a background in pure science. This indicates a strong inclination towards scientific disciplines among the respondents, reflecting a significant portion of students who pursued pure science during their SPM studies. A smaller segment, 6 respondents or 4.0%, specialized in accounting science. This group represents those who focused on the financial and economic aspects of their education during high school. Only 1 respondent, making up 0.7% of the sample, studied the literature. This minimal representation suggests a relatively low interest in or availability of literature studies among the surveyed population. The 'Others' category includes 30 respondents, accounting for 20.1% of the sample. This diverse group comprises individuals who pursued various other fields of study during high school, indicating a range of educational backgrounds that do not fall into the categories. As presented in Table 9 the types of schools attended by the respondents are detailed in the data, providing insight into their educational

backgrounds. Most respondents, 77 individuals or 51.7%, attended daily schools. This suggests that more than half of the surveyed participants received their education in regular, non-residential schools, which are typically more common and accessible. Boarding schools were attended by 33 respondents, accounting for 22.1% of the sample. This indicates that a notable portion of students experienced a residential schooling environment, which often provides a different educational and social experience compared to daily schools. Religious schools were the choice for 12 respondents, making up 8.1% of the total. This group represents those who pursued their education within religious institutions, which may offer a curriculum with a significant focus on religious studies alongside standard academic subjects. The 'Others' category includes 27 respondents, constituting 18.1% of the sample.

This diverse group encompasses students who attended various other types of schools, reflecting a range of educational environments that do not fit into the previously mentioned categories. Table 10 shows the data on respondents' awareness of the TVET Foundation Program reveals a high level of familiarity with the program among the participants. Out of 149 respondents, an overwhelming majority of 148 individuals, or 99.3%, indicated that they were aware of the TVET Foundation Program. This near-universal awareness suggests that the program is well-publicized and recognized within the community of students surveyed. In contrast, only 1 respondent, accounting for 0.7% of the total, reported not being aware of the TVET Foundation Program.

Table 9. Types of school

Types of School	Frequency	Percent
Daily school	77	51.7
Boarding	33	22.1
Religious school	12	8.1
Others	27	18.1
Total	149	100.0

Table 10. Awareness of TVET foundation program

Awareness of TVET Foundation Program	Frequency	Percent
Yes	148	99.3
No	1	0.7
Total	149	100.0

Table 11. Factors affecting choice

The Main Factors Influence the Decision to choose the TVET Foundation Program	Frequency	Percent
Interest	61	40.9
Career opportunity	73	49.0
Parental choice	8	5.4
Others	5	3.4
No other option	2	1.3
Total	149	100.0

This minimal lack of awareness indicates that almost all students have been exposed to information about the program. The survey data highlights various factors that influenced respondents' decisions to choose the TVET foundation program and is presented in Table 11. The leading factor was career opportunities, cited by 73 respondents, representing 49.0% of the total. This indicates that nearly half of the participants were motivated by the potential for future employment and career advancement associated with the TVET Foundation Program. Interest in the field was the second most influential factor, with 61 respondents, or 40.9%, indicating that their personal interest in TVET disciplines played a significant role in their decision-making process. This suggests a strong intrinsic motivation among a substantial portion of the students. Parental choice influenced 8 respondents, making up 5.4% of the sample. This demonstrates that, for a minority of participants, parental guidance or preference was a key determinant in their selection of the TVET Foundation Program. The 'Others' category, which includes 5 respondents or 3.4%, represents various other unspecified reasons that influenced their decision. Lastly, 2 respondents, accounting for 1.3%, chose the TVET Foundation Program because they had no other options available. This indicates that for a very small fraction of the respondents, the decision was made of necessity rather than preference.

The survey data reveals key factors that influenced students' decisions to choose the TVET foundation program. The most significant factor was career opportunities, which motivated nearly half of the respondents. This highlights the importance students place on the program's potential to enhance their future employment prospects and career advancement. The choice of the TVET foundation program is largely driven by its perceived value in securing a stable and promising career path. Interest in the field also played a crucial role in the decision-making process. A substantial number of respondents were guided by a genuine passion for TVET disciplines. This indicates that many students are intrinsically motivated, choosing the program not just for its practical benefits, but also because it aligns with their personal interests and aspirations. Parental choice influenced a smaller portion of the respondents, reflecting the role of family in shaping educational decisions.

While not the dominant factor, parental guidance still holds sway for some students, indicating that family expectations and support continue to be important considerations in their educational choices. The 'Others' category encompasses a variety of unspecified reasons that influenced the decision to enroll in the program. This suggests that there are additional, perhaps more personal or unique, motivations that were not captured by the main factors but are nonetheless important to a subset of students. Lastly, a few respondents selected the TVET Foundation Program because they had no other options available.

Table 12. Crosstabulation between gender and the main factors influence the decision to choose the TVET foundation program

Gender Crosstabulation			
	Gender		Total
	Male	Female	
Interest	43	18	61
Career Opportunity	52	21	73
Parental Choice	5	3	8
Others	3	2	5
No Other Option	2	0	2
Total	105	44	149

This indicates that, for a small number of students, the choice was driven by necessity rather than preference, highlighting the program's role as a viable option when other opportunities are limited. The cross-tabulation data analysis highlights the key factors influencing male and female students' decisions to enroll in the TVET Foundation Program as highlighted in Table 12. From the results, both interest and career opportunity are significant drivers for choosing the program across genders, but the influence of these factors varies between male and female students. Interest in the TVET Foundation Program is a notable factor for both genders, with a total of 61 students selecting it as their primary reason. However, the gender distribution reveals a significant disparity: 43 males reported interest as their main motivation, compared to only 18 females. This suggests that male students are more likely to be motivated by a personal interest in the program's content and offerings. The finding might reflect a stronger alignment of the TVET curriculum with traditional male-dominated fields, which typically emphasize technical skills and vocational training. Career Opportunity is the most influential factor across both genders is the perceived career opportunity, accounting for a total of 73 responses. Here again, male students (52 responses) outweigh female students (21 responses). This dominance could indicate that male students perceive the TVET Foundation Program as a strong pathway towards stable and lucrative career prospects. Although female students also recognize career opportunities, the lower response rate could be influenced by societal and cultural expectations that might limit female engagement in technical and vocational fields.

Parental Choice: Parental influence, while not a major factor overall, was cited by 8 students, with 5 males and 3 females acknowledging it. This suggests that a minority of students, regardless of gender, are guided by their parents' preferences when selecting the TVET Foundation Program. The relatively small number may indicate a trend towards more autonomous decision-making among students, who prefer to choose programs based on personal interest and career aspirations rather than parental pressure.

Other Reasons: A small group of respondents 5 students in total cited other unspecified reasons for choosing the program, including 3 males and 2 females. This category likely includes various individual considerations that were not captured by the predefined options. The balanced gender distribution in this category suggests that unique personal circumstances influencing program choice are not strongly gender specific.

Lastly, 2 male students indicated that they chose the TVET Foundation Program because they had no other option available. This reason was not selected by any female students. This finding could reflect a segment of male students who view the program as a fallback or last resort, perhaps due to lower academic performance or fewer available alternatives that match their interests.

The analysis of the cross-tabulation data reveals distinct gender differences in the factors influencing the decision to enroll in the TVET Foundation Program. Male students tend to be motivated more by personal interest and the career opportunities associated with the program. The high response rates for these categories suggest that males are generally more aligned with the goals and structure of the TVET Foundation, which may cater to traditionally male-dominated technical and vocational fields. This finding is consistent with the study by [1], which highlighted the strong alignment of TVET programs with male-preferred skill sets and career paths, particularly in Malaysia's context, where technical fields have historically attracted more male participation due to societal norms and job market expectations.

On the other hand, female students show a lower overall participation rate in the program and are also less influenced by interest or career opportunity factors compared to their male counterparts. This could indicate potential barriers or a lack of encouragement for females in pursuing technical education paths, highlighting a gender gap that may be addressed through targeted outreach and support programs for female students. This observation is in line with the findings of [2], who noted that female participation in technical and vocational education often lags behind due to limited career guidance and cultural stereotypes that influence educational choices.

The role of parental influence is relatively minor for both genders, suggesting a trend towards self-guided decision-making among students. This is supported by the study conducted by [3] which examined the variables in parental decision-making for educational choices and found that contemporary students increasingly prefer to make autonomous decisions, prioritizing their own interests and career aspirations over traditional parental preferences.

However, the few instances of no other option as a factor, exclusively reported by male students, might point to socioeconomic or academic constraints that lead some students to choose the program by necessity rather than preference. Such findings resonate with the analysis by [4]

which discussed how limited access to diverse educational opportunities can influence students' enrollment decisions, particularly in lower socioeconomic settings. These findings suggest a need for gender-sensitive strategies in promoting the TVET Foundation Program. Addressing the gender disparity could involve initiatives to increase female interest and participation, such as introducing more female role models in the field, offering mentorship programs, and ensuring that the curriculum reflects diverse career paths that appeal to both male and female students. Additionally, understanding the emphasis on career opportunities may guide program administrators in tailoring their communication strategies, highlighting the program's alignment with evolving job market demands to attract a broader and more diverse student base. Table 13 shows the cross-tabulation analysis between the main factors influencing the decision to choose the TVET Foundation Program with the field of study during high school. It reveals key trends that suggest the influence of cultural and educational background. Students with a Pure Science background dominate the dataset, making up most respondents across all factors, particularly for those driven by interest (50 out of 61) and career opportunity (51 out of 73).

This indicates that students from science-oriented fields are more inclined towards the technical and practical learning approaches offered by TVET programs, aligning with the career paths typically associated with Pure Science disciplines. In contrast, there is minimal representation from Accounting Science and Literature backgrounds, with only a few students from these fields citing career opportunities (6 from Accounting Science and 1 from literature). This could reflect cultural or educational biases favoring more academic or professional fields such as business or humanities, where TVET programs are less traditionally considered as a preferred choice. Based on Table 13, students categorized under Others (30 out of 149) show varied motivations, with a notable portion choosing the program based on interest (11) and career opportunity (15).

Table 13. Cross tabulation between the main factors influences the decision to choose the TVET Foundation Program and field of study during high school

Field of study during high school Crosstabulation					
	Field of Study During High School				Total
	Pure Science	Accounting Science	Literature	Others	
Interest	50	0	0	11	61
Career Opportunity	51	6	1	15	73
Parental Choice	6	0	0	2	8
Others	4	0	0	1	5
No Other Option	1	0	0	1	2
Total	112	6	1	30	149

This diversity suggests that non-traditional or mixed academic backgrounds may lead to more openness towards vocational training as an alternative pathway. The role of parental choice is relatively low across all fields of study, with only a small number from Pure Science and Others categories citing it as a primary influence (6 and 2, respectively). This implies a trend towards independent decision-making, particularly among students with a strong academic foundation in science, who may prioritize their own career interests over familial expectations. The findings suggest that cultural factors linked to educational background influence the decision to enroll in TVET programs, with a clear preference among students from science-oriented fields. To broaden the appeal of TVET education, program administrators may need to address cultural perceptions and increase awareness of the diverse career opportunities available, particularly for students from non-science backgrounds.

5. Conclusion, Limitation and Future Directions

In conclusion, this scopic review has highlighted the transformative impact of emerging technologies on the future of educational settings. From personalized learning facilitated by intelligent tutoring systems to immersive learning experiences in virtual classrooms and game-based learning platforms, technological advancements are reshaping traditional educational paradigms. Innovations such as automated teaching assistants, secure credentialing using blockchain, and centralized learning platforms have enhanced accessibility, engagement, and efficiency across educational institutions.

Advancements in AI, machine learning, and augmented reality promise to further personalize learning experiences, improve educational outcomes, and foster collaborative environments. These technologies not only cater to diverse learning needs but also empower educators with tools to deliver adaptive and interactive instruction. As we look forward, the integration of advanced computational capabilities and the evolution of MOOCs (Massive Open Online Courses) are set to make learning more accessible globally. Ultimately, the future of education sits at the intersection of technology and pedagogy, where continuous innovation holds the key to addressing challenges and unlocking new opportunities in teaching and learning. Embracing these trends will be crucial in preparing learners for the dynamic demands of the 21st century, ensuring that education remains relevant, inclusive, and impactful in shaping the leaders and innovators of tomorrow. On the other hand, it also concluded that career opportunities and personal interest are the primary factors driving students' decisions to enroll in the TVET foundation program, highlighting its appeal as both a pathway to stable employment and a field of genuine passion. Parental influence and other unspecified reasons also play a role, though to a lesser extent, indicating that while external guidance and unique personal circumstances are factors, the main motivators are closely tied

to the program. To enhance the appeal of the TVET Foundation Program, it is recommended to strengthen partnerships with industry to improve career prospects, increase engagement initiatives that align with students' interests in TVET fields, and provide targeted communication to parents to better inform them of the program's benefits. These strategies can help attract a broader range of students by addressing both intrinsic motivations and external influences. The current study offers valuable insights into the integration of emerging technologies in education and the factors influencing students' choices for the TVET Foundation Program.

However, it faces certain limitations that could impact on the overall findings. One significant issue is sample bias, as the survey participants were primarily students already interested in vocational education, possibly skewing the results towards a favorable view of TVET programs. Although the response rate was high (92%), this may not fully represent a broader, more diverse student population. Additionally, the study's heavy reliance on well-known academic databases (such as Google Scholar, ScienceDirect, Scopus, PubMed, and IEEE Xplore) may introduce a selection bias, as relevant studies from smaller, regional publications might have been overlooked. This can limit the depth of the literature review, particularly regarding emerging educational trends in different cultural or regional contexts. Another limitation of the study is its cross-sectional design, which captures a single point in time and may not fully reflect changing preferences and attitudes towards education and technology integration. The dynamic nature of the job market and rapid advancements in educational technologies suggest that student motivations can evolve quickly, making it challenging to generalize these findings for future contexts. The emphasis on current trends might not account for longer-term shifts in how students choose their educational pathways or respond to new technologies in learning environments.

This limits the ability to forecast future changes in student behavior and preferences accurately. To address these issues, future research will consider a longitudinal approach, examining how student motivations and preferences develop over time as technology continues to advance. Expanding the sample to include students from a variety of educational backgrounds and regions would help mitigate sample bias and enhance the generalizability of the results. Qualitative methods, such as interviews and focus groups, could also be valuable in exploring students' deeper motivations and perceptions of emerging technologies. Finally, examining the long-term impacts of AI-driven tools, immersive learning environments, and blockchain for credentialing could provide more empirical evidence, helping policymakers and educators design effective, inclusive strategies for integrating technology in education. The findings of this study have significant implications for policymakers and educational institutions. The identified trends, such as the importance of career opportunities and personal interest in choosing the TVET Foundation Program, suggest that aligning curriculum design with industry demands and integrating emerging technologies like AI and immersive learning can enhance student engagement and outcomes. For policymakers, these insights highlight the need for targeted investments in educational technologies and strategic initiatives to reduce the gender and cultural disparities observed in program enrollment. Future research could explore the long-term effects of integrating these technologies, offering evidence-based guidance for creating inclusive, adaptive educational policies that better prepare students for evolving job market demands. Building on these implications, it reveals that the integration of advanced educational technologies in TVET programs could be transformative in bridging skill gaps and aligning student capabilities with industry needs.

The prominence of career opportunities as a deciding factor suggests a strong student preference for education that is directly linked to employability. leveraging AI-driven personalized learning platforms, educational institutions can tailor content delivery based on individual learning styles and career goals, enhancing the overall student experience and outcomes. Additionally, immersive technologies like AR and VR can be employed to simulate real-world job scenarios, providing hands-on training in a controlled, risk-free environment that is especially beneficial for technical and vocational education. For policymakers, the focus should be on fostering public-private partnerships that can bring these technologies into the classroom, developing a curriculum that is agile and responsive to technological advances. Moreover, addressing cultural and gender disparities highlighted in the study requires inclusive strategies, such as mentorship programs, scholarships, and outreach initiatives aimed at underrepresented groups. Ultimately, the findings emphasize the need for a dynamic and adaptive approach in educational planning, one that continuously evolves to meet the challenges of an increasingly technology-driven future.

Acknowledgments

This research was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through Contract Grant UTHM Q623. The authors would like to thank UTHM for supporting this research and polytechnics who participate the survey.

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