

Trends in the Use of AI-Based Multimedia Learning in Vocational Education: A Literature Review

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Abstract - Learning methods have been profoundly altered by the quick growth of artificial intelligence (AI), especially with regard to the creation of AI-based multimedia in vocational education. It is challenging to determine current research trends and future directions since the data is still dispersed across several fields, despite the growing quantity of linked studies. Thus, the purpose of this study is to discover new research issues, implementation trends, and research gaps by methodically reviewing the evolution of AI-based multimedia learning in vocational education. Using the ScienceDirect database, a Systematic Literature Review (SLR) was carried out in accordance with PRISMA 2020 standards. The Boolean search term ("Artificial Intelligence" OR "Machine Learning") AND ("Multimedia Learning" OR "Interactive Multimedia") AND ("Vocational Education") was used to obtain literature. 219 publications were found throughout the selection process; 17 empirical research papers that satisfied the predetermined inclusion criteria were subjected to descriptive and theme synthesis analysis. The findings indicate that recent studies increasingly emphasize competency-based vocational training, digital learning environments, manufacturing process design, and the integration of industrial standards with intelligent learning technologies. Furthermore, bibliometric mapping using VOSviewer reveals a transition from traditional vocational training toward AI-supported multimedia learning, virtual tutoring, gamification, and digital competency development. These findings demonstrate that AI-based multimedia learning has become a strategic approach to improving learning quality, learner engagement, and workforce readiness in vocational education. The study provides comprehensive insights into current research trends while highlighting future opportunities for integrating intelligent technologies into vocational teaching and learning practices.

Keywords - Artificial Intelligence, Machine Learning, Multimedia Learning, Interactive Multimedia, Vocational Education, Systematic Literature Review, VOSviewer.

I. INTRODUCTION

Advances in digital technology, artificial intelligence (AI), and global industrial transformation have reshaped the paradigm of education in the 21st century. Education systems must develop human resources that are flexible, innovative, and able to collaborate with smart technology in order to meet the demands of the Fourth Industrial Revolution and the shift to Society 5.0 [1], [2]. Because AI can personalise learning, it has emerged as one of the most significant technologies in the field of education, analyze learning data, automate assessment, and provide real-time feedback [3], [4]. According to a number of studies, artificial intelligence (AI) is no longer seen as a technology of the future but rather as a crucial component of

the contemporary learning environment that may improve the calibre of students' educational experiences and the efficacy of instruction [5], [6]. Additionally, AI makes it possible to design learning environments that are more flexible, adaptable, and learner-centred, thereby supporting the development of the competencies needed in the digital age [7].

However, as business becomes more digitalised, vocational education, also known as Technical and Vocational Education and Training (TVET), is confronted with more difficult problems. The TVET system has undergone a thorough transformation to better meet the demands of the digital economy and the global labour market as a result of the Fourth Industrial Revolution, Society 5.0, and the advancement of technologies like artificial intelligence (AI), the Internet of Things (IoT), big data, and automation [8], [9]. Changes in the structure of the workforce, the automation of production processes, and the growing demand for digital skills require vocational education institutions to transform their curricula, learning strategies, and assessment systems. Various studies confirm that TVET curricula must be dynamically adapted to advancements in industrial technology through the integration of digital competencies, AI, and data analytics, as well as closer collaboration with the business and industrial sectors, so that graduates possess competencies relevant to the job market of the future. [10], [8].

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The nature of vocational education, which is focused on mastering job-related competencies, requires a learning process that is not merely theoretical but also capable of replicating real-world work situations. Therefore, learning approaches based on simulations, virtual laboratories, teaching factories, immersive learning, and interactive multimedia are becoming increasingly important for bridging the gap between the learning experience and actual industrial conditions, so that students gain authentic experience before entering the workforce [11]. However, various studies report that there remains a gap between graduates' competencies and industry needs, limited practical training facilities, and low integration of digital technology into the vocational learning process. This gap means that TVET graduates are not yet fully capable of meeting the digital and adaptive skill requirements of modern industry, necessitating curriculum innovation, improvements in educators' competencies, and investment in digital infrastructure and partnerships with industry [10].

Educational multimedia has evolved significantly in tandem with the advancement of artificial intelligence (AI). Multimedia, which initially served only as a medium for conveying information, has now evolved into AI-Based Multimedia Learning, which is capable of tailoring learning materials to learners' characteristics, providing automatic learning recommendations, and supporting more dynamic interactions through smart technology [12], [3].

The integration of AI with multimedia has led to various innovations in learning, such as Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), Intelligent Tutoring Systems (ITS), adaptive learning platforms, educational chatbots, virtual simulations, and Generative AI, all of which are intended to produce learning experiences that are more individualised, flexible, and sensitive to learners' needs [13], [14]. By providing students with a more genuine, dynamic, and contextual learning experience, these technologies boost student engagement and the process' efficacy [15], [3]. Because AI-based multimedia may replicate real-world work situations, improve practical skills, and enable competency-based learning that is more successful than traditional methods, it is particularly relevant in vocational education [16]. Additionally, by offering adaptive learning and real-time feedback, AI-based multimedia can improve learning motivation, student engagement, problem-solving abilities, learning outcomes, and job preparedness in a variety of occupational sectors, according to several studies [17].

Nevertheless, There are still a number of obstacles to overcome before AI-Based Multimedia Learning may be used in vocational education. The preparedness of digital infrastructure, the technological proficiency of educators, the expense of deploying smart technology, data security and privacy, and the moral implications of using AI in education are some of these difficulties [16], [18], [19]. Concerns over an over-reliance on technology, possible algorithmic bias, a decline in social interaction during the learning process, and the risk of discrimination resulting from the use of non-representative data [20], [21], [22]. Numerous studies have also demonstrated that organisational preparedness, in addition to technological competence, determines the effectiveness of AI implementation, policy support, a culture of innovation, teachers' digital competencies, and educators' ability to integrate technology into teaching practices [18], [23].

Therefore, a more comprehensive understanding is needed of how AI-based multimedia learning is implemented, the benefits it yields, the factors that influence the success of its implementation, and the challenges faced in the context of vocational education, so that this understanding can serve as the foundation for developing effective, ethical, and sustainable AI-based learning strategies. [16], [24].

Based on the above discussion, this study aims to analyze trends in the use of AI-Based Multimedia Learning in vocational education during the 2020–2026 period through a Systematic Literature Review (SLR) approach. This study focuses on identifying trends in publications, the AI technologies used, the forms of multimedia learning developed, the benefits of implementation, the challenges faced, and opportunities for future research. This emphasis is consistent with research showing that the application of AI in vocational education is expanding quickly, including adaptive learning, intelligent tutoring systems, virtual simulation, automated assessment, and AI-assisted multimedia but still requires a comprehensive synthesis of trends, effectiveness, and future development directions [16]. The research questions for this debate are as follows:

1. What are the trends in publications on AI-Based Multimedia Learning in vocational education during the 2020–2026 period?
2. What kinds of AI technologies are being used in vocational education's multimedia learning?
3. What types of AI-based multimedia learning have been established in vocational education, and what are their features?
4. What are the advantages of using AI-based multimedia learning for vocational education's learning objectives and process?
5. What are the difficulties and barriers to integrating multimedia learning powered by AI in vocational education?

II. RESEARCH METHODS

In order to locate, assess, and compile research findings on the use of AI-Based Multimedia Learning in vocational education between 2020 and 2026, this study uses the Systematic Literature Review (SLR) technique. The SLR approach was selected because, in contrast to a narrative literature review, it offers a thorough, methodical, clear, and repeatable synthesis of scientific information, producing a more objective picture of progress in a study subject. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) standards, which include the phases of identification, screening, eligibility assessment, and article inclusion, were adhered to in the study reporting procedure. The search, selection, and publication of the study's findings were made more transparent by following these criteria [25].

The ScienceDirect (Elsevier) database, which offers globally renowned scientific papers pertinent to the domains of education, educational technology, computer science, and engineering, was the source of the study data. Boolean operator-based keywords, such as (Artificial Intelligence OR Machine Learning) AND (Multimedia Learning OR Interactive Multimedia) AND ("Vocational Education"), were used in the literature search. In order to find material that was extremely pertinent to the study goals, the search method was used to the article titles, abstracts, and keywords [26].

The following criteria are used for inclusion: (1) empirical research articles published between 2020 and 2026; (2) articles published in respectable international journals that are accessible on ScienceDirect; and (3) research that discusses the use of artificial intelligence in digital learning technologies, multimedia learning, or vocational education ; and (4) articles written in English. (5) Articles must be research articles; (6) articles must be publicly accessible and downloadable; and articles lacking complete metadata are excluded from the selection process. [27], [25]. For a clearer explanation, see the prism diagram in the research diagram below:

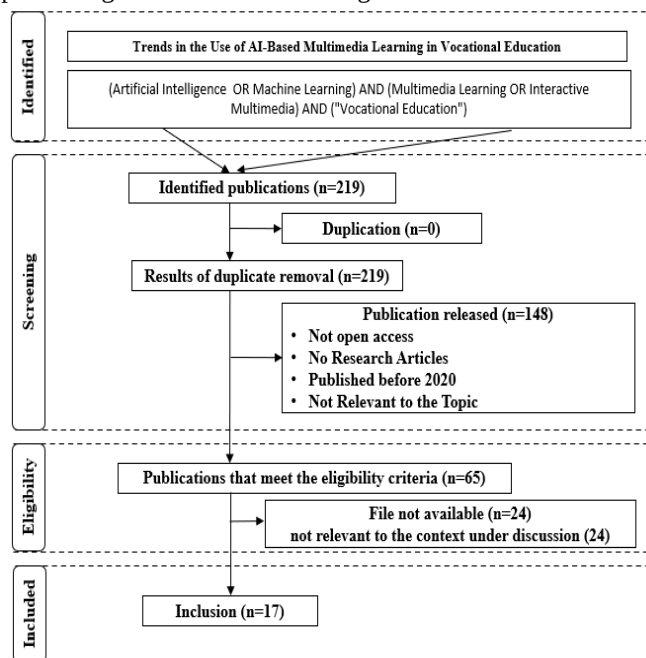


Fig.1. Prism method for article search

The four primary phases of the article selection process identification, screening, eligibility, and inclusion were carried out methodically in accordance with the PRISMA flowchart. During the identification phase, a combination of keywords ("Artificial Intelligence" OR "Machine Learning") AND ("Multimedia Learning" OR "Interactive Multimedia") AND ("Vocational Education") were used to search the ScienceDirect database for relevant material. This search strategy yielded 219 publications relevant to the research topic. After reviewing the retrieved articles, no duplicate articles were found ($n = 0$), so all 219 publications proceeded to the next screening stage.

All publications were chosen during the screening phase on the basis of their titles, abstracts, year of publication, document type, accessibility, and significance to the study topic. 148 items were eliminated as a result of this procedure as they didn't fit the predetermined standards. The main reasons for excluding articles included those that were not fully accessible (not open access), were not research articles, were published before 2020, This has nothing to do with the study's focus on artificial intelligence's application to multimedia instruction in vocational education. 65 articles that satisfied the preliminary criteria for additional review remained after the screening procedure was finished.

A full-text review was then carried out at the eligibility stage to make sure the papers satisfied the inclusion criteria and the

goals of the study. At this stage, 24 articles were excluded from the selection process due to unavailability of the full manuscripts or the research content not being relevant to the discussion, despite their titles and abstracts appearing relevant in the previous stage. This evaluation aimed to ensure that only articles that provided genuine empirical evidence and contributed to the research topic were used in the data synthesis process.

Choosing the final papers to be examined in the research is the last step, known as inclusion. 17 publications that satisfied all inclusion criteria and were judged appropriate for additional analysis were found based on the overall selection procedure. These articles were then used as the primary sources in synthesizing findings regarding the trend of utilizing Artificial Intelligence-Based Multimedia Learning in vocational education. This methodical and open selection procedure shows that the study has applied the PRISMA 2020 principles, improving the validity, consistency, and trustworthiness of the systematic review findings and reducing the possibility of bias in the selection of literature [28].

III. RESULTS AND DISCUSSION

Using keywords ("Artificial Intelligence" OR "Machine Learning") AND ("Multimedia Learning" OR "Interactive Multimedia") AND ("Vocational Education"), the authors conducted a study. a comprehensive search on databases such as Science direct and found 219 articles relevant to the keywords used, based on their abstracts and titles that met our specific requirements. Based on all categorised inclusion criteria, including published publications within the previous six years, a total of seventeen articles were chosen for this systematic review, open access articles, research articles, articles according to the topic and all publications that did not match these criteria were excluded and did not enter the next analysis process. Table 1 below provides an explanation of the list of papers that were approved to the next stage.

Table 1
Synopsis of Articles Received Between 2020 and 2026

No	Country	Author	context
1	China	Feifei Zheng, Huadi Wang, Xueying Gu, Gongjing Wang [29]	Using Generative Artificial Intelligence Learning (GAIL) to help Chinese vocational college students develop Higher-Order Thinking Skills (HOTS).
2	Germany	Juliane Schuldt, Anna Sorgatz, Sophie Gröger Chemnitz [30]	Developing a smart learning environment as an innovative learning medium.
3	Indonesia	Sherly Rahmawati, Sarah Prestridge, Ade Gafar Abdullah, Isma Widiaty [31]	The low digital competency of vocational education teachers in Indonesia amidst rapid technological developments.

4	Anna Sorgatz, Juliane Schuldt, Sophie Gröger [30]	Germany	Developing Artificial Intelligence (AI)-based multimedia learning.
5	Alma C. Asuncion, Aldous de Vera Asuncion, Jamela G. Macalipis, Chariza Mae T. Borromeo, Janet C. Rivera, Mark R. Limon [32]	Philippines	The skills mismatch between the skills possessed by students in the Garments Education Technology (GET) program and the competencies required by industry during Work Immersion (WI).
6	Huawei Qin, Junya Yan, Xiaobo Liu, Zhuanghua Zhu [33]	China	In creating a digital competence assessment methodology for vocational education instructors that is based on artificial intelligence (AI),
7	Vito Candido, Alberto Cattaneo [34]	Switzerland	the impact on student cognitive load and learning results by using the Cognitive Theory of Multimedia Learning (CTML) principles in Augmented Reality (AR)-based instructional materials.
8	Charlotte Larmuseau, Laetitia De Leersnijder, Jelle Demanet, Tammy Schellens, Tijs Rotsaert, Carl Boel [35]	Belgium	The impact of learning environment design based on virtual reality (VR) on student learning results, cognitive load, and learning motivation.
9	Nianzi Wua, Yue Qiu, Guiling Li [36]	China	the use of 3D virtual reality (VR) technology in conjunction with data visualisation technologies to facilitate the creation of 3D virtual art.
10	Lulu Zhou, Dazhi Zhao [37]	China	The increasingly complex network security challenges due to the rise in cyberattacks on internet infrastructure.
11	Ji Jin Zhu [38]	China	attempts to raise the standard of instruction in vocational education

			by using learning techniques focused on enhancing professional expertise.
12	Sujan Ghimire, Shahab Abdulla, Lionel P. Joseph, Salvin Prasad, Angela Murphy, Aruna Devi, Prabal Datta Barua, Ravinesh C. Deo Rajendra Acharya, Zaher Mundher Yaseen [39]	Australia	The development of a prediction model for student academic performance in tertiary preparatory programs using an educational data mining approach.
13	Alberto A.P. Cattaneo, Chiara Antonietti, Martina Rauseo [40]	Switzerland	Swiss Vocational Education and Training (VET) and Teachers' Digital Competence (TDC).
14	Junna Hou [41]	China	Development of a Zope/Plone-based platform that provides knowledge management features and discussion forums.
15	Katherine (Ke) Li, Jayakaran Mukundan, Vinothini Vasodavan [42]	Malaysia	Artificial Intelligence (AI) is used in English language instruction through integrated learning.
16	Yan Wang, Yang Luo [43]	China	creation of a computer-aided interface design approach that incorporates virtual reality (VR) technology.
17	Noshin Tusnim Arpa, Md Jahangir Alam [44]	Bangladesh	Bangladeshi secondary schools are implementing a new skills-based curriculum.

Publication Keyword Mapping

In order to find literature that particularly addresses the incorporation of Artificial Intelligence (AI) or Machine Learning (ML) in the creation of Multimedia Learning or Interactive Multimedia in the context of Vocational Education, a publication keyword mapping was created. Combinations of keywords ("Artificial Intelligence" OR "Machine Learning") AND ("Multimedia Learning" OR "Interactive Multimedia") AND ("Vocational Education") were structured using Boolean operators to optimize the search process. The OR operator was used to accommodate the varying terminology used in scientific publications, while the AND operator ensured that each selected article covered all key research concepts. This strategy resulted in more systematic, relevant, and representative search results, demonstrating the advancements

in research on artificial intelligence's use to multimedia instruction in vocational education. Figure 1 provides a visualization below:

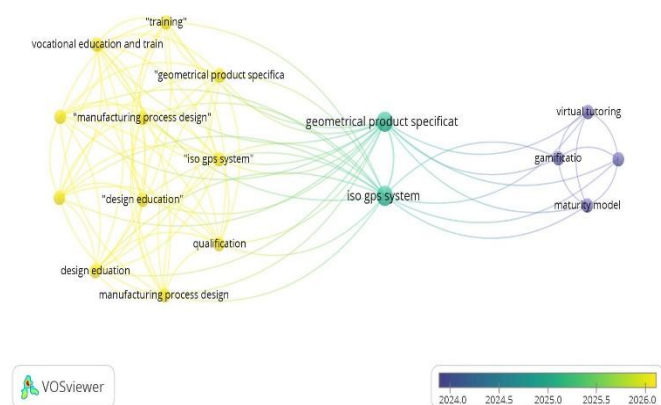


Fig.2. Bibliography based on vosviewer

Based on the overlay visualization generated using VOSviewer software, it can be seen that the research keyword network illustrates the conceptual relationships between topics related to Artificial Intelligence (AI), Multimedia Learning, and Vocational Education. Each node (circle) in this visualisation reflects a keyword that appears in the article; the size of the node shows how frequently the keyword appears in the publication. The connection or co-occurrence that is, the degree to which two or more keywords exist concurrently in the same article is shown by the lines joining the nodes. The more and thicker the connecting lines, the stronger the conceptual relationship between the topics. In addition, the colors on the nodes follow the time scale (overlay visualization), where blue-purple indicates topics that appeared earlier (around 2024), green indicates developments in the middle period (around 2025), while yellow indicates topics that became the latest trends in the period 2025 to 2026.

According to the mapping results, the terms "geometrical product specification" and "ISO GPS system" are fundamental to the network. These two keywords function as bridge keywords connecting previous research groups with newer research groups. According to this view, the ISO Geometrical Product Specification (ISO GPS) system and geometric product specification standards are significant themes that link different studies on vocational education, especially in the areas of manufacturing, engineering design, and competency-based training. The high connectivity of these two keywords indicates that research on industrial standards is starting to be integrated with digital learning approaches and student competency development in vocational education.

On the left side of the visualization, a cluster of yellow keywords appears, such as "training," "vocational education and training," "manufacturing process design," "design education," "qualification," and "geometrical product specification." These clusters are closely related to each other, indicating that most recent research still focuses on improving the quality of vocational education through training, job competency development, design education, and manufacturing process learning. The dominance of yellow indicates that these topics are the primary focus in the most recent publications. This reflects a growing body of research that highlights how crucial it is to align vocational education

programs with industry demands by enhancing professional standards and technical capabilities.

Meanwhile, in the center of the network, "ISO GPS system" and "geometrical product specification" serve as links to research groups more oriented towards the digital transformation of learning. These two keywords have direct connections to several topics such as "gamification," "virtual tutoring," and "maturity model" located on the right side of the visualization. This connection suggests that research is moving away from the conventional emphasis on technical competency requirements and toward the use of digital technology as a teaching tool. In other words, industry standards are no longer studied conventionally, but are starting to be combined with technology-based teaching methods to increase the efficiency of the learning process in settings for vocational education.

The keyword cluster on the right, dominated by blue to purple, consists of "gamification," "virtual tutoring," and "maturity model." The existence of these terms suggests the introduction of new topics pertaining to the use of digital technology in education, even though the number of linkages is less than that of the cluster on the left. Gamification describes the application of game elements to increase student motivation and engagement, while virtual tutoring indicates the development of learning systems based on digital mentoring or artificial intelligence. Maturity models are widely used to evaluate the level of readiness of institutions or educational systems to implement digital transformation. These three topics demonstrate that research is shifting toward developing more adaptive, interactive, and technology-based learning environments.

Overall, the VOSviewer visualization shows that research development is moving from themes oriented towards technical competency standards, training, and manufacturing processes, in the direction of using digital technologies into vocational education instruction. The pattern of connections between keywords shows that learning innovation is not only focused on mastering technical skills, but also on developing more effective learning methods through gamification, virtual tutoring, and digital transformation readiness evaluation models. These results show that the integration of AI, interactive multimedia, and digital technology as strategies to enhance learning quality, graduate competencies, and preparedness to meet industrial demands in the Industry 4.0 and Society 5.0 eras is the current direction of vocational education research. The following research questions will be addressed by a more thorough investigation:

1. What patterns can be seen in articles about AI-Based Multimedia Learning in Vocational Education from 2020 to 2026?

Considering the findings of the synthesis of the examined research publications, the publication trend regarding Artificial Intelligence (AI)-Based Multimedia Learning in vocational education shows increasing development during the period 2020–2026. At the beginning of the period (2020–2021), research was still dominated by the development of interactive multimedia, Computer-based learning resources and digital simulations designed to enhance students' practical abilities in vocational education settings [45]. Entering the 2022–2023 period, the research focus is starting to shift towards the integration of Artificial Intelligence (AI), Machine Learning,

and adaptive learning systems to provide personalized materials, automated feedback, and support more effective competency-based learning [46], [47]. Furthermore, in the 2024–2026 period, research developments will increasingly be directed towards the application of virtual tutoring, gamification, learning analytics, intelligent tutoring systems, and intelligent learning environments that can increase learning engagement, job skills, and preparedness of graduates to meet the demands of the digital sector [48], [49].

These findings are reinforced by the VOSviewer visualization results, which show a shift in research focus from traditional themes such as training, manufacturing process design, and vocational education and training to more innovative topics, such as virtual tutoring, gamification, and maturity models. This shift indicates that current vocational education research is no longer solely oriented towards mastering technical skills, but also incorporates AI technology to make learning more dynamic, adaptable, and learner-centred. In line with this, AI is seen as capable of transforming vocational education through personalized learning, real-time student performance analysis, virtual simulations, and increasing the effectiveness of competency-based training. Consequently, graduates will be more equipped to handle the challenges of Industry 4.0 and Society 5.0 [47], [49].

2. What kinds of AI technologies are being used in vocational education's multimedia learning?

Vocational education's use of artificial intelligence (AI) technology in multimedia instruction demonstrates a growing variety of advancements, and is oriented towards improving the quality of competency-based learning [50], [51]. The most widely implemented AI technologies include machine learning, adaptive learning systems, learning analytics, generative AI, virtual tutoring, Gamification, AI-powered virtual reality (VR), and intelligent tutoring systems (ITS) [50], [52]. Machine learning is used to analyze students' learning characteristics, identify learning difficulties, and provide recommendations for materials that suit individual needs through learning data analysis [53]. Furthermore, adaptive learning systems enable multimedia learning to automatically adjust the level of difficulty, sequence of materials, and feedback based on student learning performance, improving the effectiveness and personalisation of the learning process [53].

Additionally, recent advancements demonstrate the growing application of generative AI as a learning assistant (AI co-pilot) that aids in the creation of instructional materials, provides explanations of concepts, compiles exercises, and supports the completion of vocational projects [54]. In practice-based learning, Additionally, AI technology is integrated with virtual reality (VR) to allow students to practise in a virtual setting that mimics actual industrial settings without having to deal with high operating expenses or safety hazards [51]. Meanwhile, AI-based gamification integration is able to increase motivation, engagement, and learning experience through adaptive learning scenarios [55].

3. What are the forms and characteristics of AI-based multimedia learning developed in vocational education?

The form and features of Artificial Intelligence (AI)-based multimedia learning in vocational education demonstrate advancements that lead to adaptive, interactive, contextual learning and are focused on mastering work competencies,

according to the findings of the synthesis of multiple empirical research articles [52], [56]. The multimedia developed is no longer just a combination of text, images, audio, and video, but has been combined with AI technologies like virtual tutoring, learning analytics, Intelligent Learning Systems, and immersive Virtual Reality (VR) to provide a learning environment that mimics actual workplace settings [57]. The AI system is able to automatically analyze student responses and performance, then provide feedback and learning materials tailored to the needs and ability levels of each student so that the learning process becomes more adaptive. [52].

This approach allows the learning process to become more personalized, increases student engagement, and strengthens mastery of vocational competencies needed in the world of work [57]. In addition, AI-based multimedia also integrates interactive simulations, three-dimensional visualizations, scenario-based exercises, and digital demonstrations, so that learners can safely practice technical skills before applying them to real industrial environments [56].

4. What are the advantages of using AI-based multimedia learning for vocational education's learning objectives and process?

The learning process and results in vocational education are greatly enhanced by the use of AI-Based Multimedia Learning. A more individualised, flexible, and learner-centred learning environment may be produced by combining interactive multimedia with artificial intelligence, according to empirical study. AI enables the delivery of materials tailored to individual abilities and needs through automated feedback, interactive visualizations, and practical simulations that enhance conceptual understanding and job skills. [52]. [51].

In addition, AI-based multimedia has been proven to increase learning motivation, engagement, learning satisfaction, and problem-solving abilities as learning becomes more contextualised and practical for kids [51]. In vocational education, technologies such as Virtual Reality (VR), AI Intelligent Learning Systems, and web-based collaborative learning also enhance practical competencies, work readiness, and the effectiveness of project-based learning [58]. Although some studies show that the increase in declarative knowledge is not always higher than conventional methods, AI-based multimedia consistently has a positive impact on motivation, learning experience, practical skills, and readiness to face the demands of the industrial world [51]. Consequently, the use of AI-Based Multimedia Learning is a successful tactic to raise the standard of instruction while bolstering the attainment of learning objectives in vocational education.

5. What are the difficulties and barriers to integrating multimedia learning powered by AI into vocational education?

The efficacy of AI-Based Multimedia Learning in vocational education is currently hampered by a number of issues. One major obstacle is teachers' limited competence in utilizing AI technology, preventing educators from fully designing learning that integrates artificial intelligence with the needs of vocational practice [59], [60]. In addition, inadequate digital infrastructure, such as limited hardware, internet access, and AI-based learning platforms, is an obstacle to optimal learning implementation [61].

Additionally, research indicates that the application of AI is currently incomplete and has not been methodically incorporated into the educational process due to a lack of implementation guidelines, curriculum design, and defined institutional regulations [60]. On the other hand, students expect a more personalized learning experience, more authentic practice, and direct guidance from instructors when using AI technology [62]. Other challenges include low AI literacy, the need for ongoing training for teachers, and the importance of balancing conceptual material with industry-based practices so that the competencies developed are in line with the demands of the workplace [59].

IV. CONCLUSION

Based on the findings of the Systematic Literature Review (SLR), it can be said that Artificial Intelligence (AI)-Based Multimedia Learning has a lot of potential to raise the standard of instruction in vocational education by offering a more dynamic, flexible, and learner-centred learning environment. Numerous research have demonstrated that using AI may improve student engagement, mastery of practical skills, personalized learning, and preparedness of graduates to face the needs of the industrial world. However, its implementation still faces several challenges, including limited educator competency, inadequate technological infrastructure, low AI literacy and inadequate incorporation of AI into educational policies and curricula. Therefore, the successful implementation of AI-Based Multimedia Learning requires support for teacher competency development, the provision of adequate digital resources, the development of an adaptive curriculum, and close collaboration between educational institutions, the government, and the industrial world. These efforts are expected to create an innovative, relevant, and sustainable environment for vocational education in the context of Industry 4.0 and Society 5.0's digital revolution.

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