E-Learning Platform for Enhancing 21st Century Skills for Vocational School Students: A Systematic Literature Review

Mochamad Kamil Budiarto, Asrowi, Gunarhadi, Ravik Karsidi and Abdul Rahman
Department of Doctor of Education, Faculty of Teacher Training and Education, Universitas Sebelas Maret, Surakarta, Indonesia

mkbudiarto@student.uns.ac.id
asrowi@staff.uns.ac.id
gunarhadi@staff.uns.ac.id (correspnding author)
ravikkarsidi@yahoo.com
abdul.rahman@staff.uns.ac.id

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Abstract: The importance of skills for vocational high school graduates in entering the workforce, facing competition, and increasing productivity, in accordance with the current industry needs, cannot be overstated. E-learning has become one of the platforms that vocational high schools can utilize to assist students in acquiring the necessary skills such as literacy, communication, collaboration and critical thinking as needed in the 21st century. However, the issue lies in determining the type of e-learning that can enhance students' learning outcomes and skills. This paper aims to present an analysis and description of the implementation of different types of e-learning in vocational high school education. The research adopts a systematic literature review approach, incorporating research questions: i) what types of e-learning are being used? ii) what are the impacts of implementing e-learning in vocational high schools? and iii) what competencies can be enhanced through the implementation of e-learning. The subject of this research is articles that have been published in Scopus and Google Scholar-indexed journals. The article selection technique employed the PRISMA method, which successfully obtained 35 articles out of the 2,093 articles. The review results indicate that there are many variations in the utilization of e-learning formats in schools. Digital learning media is one type of e-learning that is often used by teachers, although there are many other types such as e-modules, Learning Management System, multimedia, and others. In addition, the research findings showed that through e-learning, many 21st-century skills, such as literacy and critical thinking abilities can be improved. The findings further showed that e-learning contributes to the improvement of learning outcomes in psychomotor and cognitive aspects. These research findings are expected to serve as a basis for vocational school teachers to confidently utilize e-learning in their teaching activities.

Keywords: e-Learning, Vocational, 21st century skills, Smartphone, Multimedia

1. Introduction

In the 21st century, the purpose of education is to equip students with the necessary skills and knowledge to thrive in both their professional and personal lives. Numerous studies conducted in different countries have explored the implementation of e-learning as a means of facilitating learning activities (Rababa, 2021; Ahn and Edwin, 2018; Ejdys, 2021). Although e-learning's role in skill development or acquisition for vocational students has been minimally researched using systematic literature review methods, the existing literature primarily focuses on its application in public schools, universities, health fields, language learning, science learning, and the use of technological devices in education from elementary to college level. This research, which includes systematic literature review, bibliometric analysis, scooping review, and meta-analysis, has shown that e-learning is predominantly used in these areas. However, there is a need for more comprehensive research on its effectiveness for vocational students (Ramadiani *et al.*, 2020; Azmi and Widiaty, 2021; Sumarmi *et al.*, 2021).

It is important to clarify that electronic-based learning is not necessarily synonymous with online learning. Some define it as any form of learning that incorporates technology, such as computers and smartphones, and this perspective is commonly accepted as part of the broader application of electronic-based learning (Naveed and Ahmad, 2019)(Aini et al., 2020). Hence, it has been recognized that electronic learning has been adopted in nearly all nations over the recent years. However, the utilization of e-learning in developed countries cannot be equated to that in developing countries, because developed countries have indeed embraced electronic-based learning (Widyaningsih *et al.*, 2020; Alshammari, 2020; Ghosh, Muduli and Pingle, 2021).

In Indonesia, a vocational high school stands out as an educational institution that is highly committed to preparing students with the necessary 21st-century skills for the workforce (Kovalchuk *et al.*, 2022; Soenarto *et*

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al., 2020). It is widely acknowledged that graduates from Vocational High Schools are equipped with the necessary skills to seamlessly transition into the workforce. This underscores the significance of aligning learning activities with the demands of the industry (Soenarto *et al.*, 2020; Mukhadis, Ulfatin and Putra, 2019). In this context, every aspect of learning is designed to create graduates who have skills and knowledge that match the demands of the workplace (Yudiono *et al.*, 2022; Mulyadi, 2019). Educational programs deliver more than theoretical knowledge and simultaneously allocate space for practice in the applied world where relevant skills can be learned and put to use afterwards in a professional context. Including practical experience, industry-based projects and internships as the core elements of the curriculum are making these educational establishments to become the breeding grounds for the students being able to obtain technical knowledge and personal competences on which nowadays the industry has the highest demand (Yondri *et al.*, 2020; Durmus and Dağlı, 2017).

Based on various research analyses, it has been empirically demonstrated that Indonesia's open unemployment rate (TPT) in August 2022 stood at 5.86%, which translates to approximately 8.42 million individuals (Sulistiobudi and Kadiyono, 2023). Notably, graduates from Vocational High Schools (SMK) are found to be the primary contributors to this unemployment rate (Rokhim, 2023; Nazira and Kartika, 2021). However, it is crucial to understand that this situation cannot be examined in isolation, as it is intricately linked to multiple factors, one of which is the job search process. It appears that there exists a disparity between the skills acquired by students and the demands of the business and industry sectors (Wahyudi, Suharno and Pambudi, 2023; Ohara, Harto and Maruanaya, 2020). It is evident that there is a growing recognition of the significance of skill and competency development for vocational high school students in Indonesia, particularly in light of the evolving job market. Evidence showed that vocational high schools play an important role in equipping students with the practical skills required by industry, thereby preparing them to enter the professional industry (Mahmudah and Santosa, 2021). The Indonesian Ministry of Education and Culture firmly states that through the incorporating ICT into learning activities, it will significantly enhance the academic performance of vocational high school (SMK) students. Consequently, these students will have a greater chance of securing employment in diverse industrial sectors, surpassing the employment rates of high school graduates (Wagiran, Pardjono and Sofyan, 2020; Suharno, Pambudi and Harjanto, 2020). Hence, prioritizing the enhancement of skills among vocational high school students is crucial. By emphasizing electronics or ICT in the learning process, graduates will possess not only theoretical knowledge but also practical skills. This will enable students to effectively adapt to complex and dynamic work environments, thus overcoming challenges with ease.

Apart from issues related to the application of ICT to education which is currently not optimally implemented by teachers in vocational high schools, it turns out there are other problems that need attention, namely regarding the mismatch between the skills required by employers and the skills taught in educational institutions (Rosina *et al.*, 2021; Mukhadis, Ulfatin and Putra, 2019). Teachers can implement a variety of strategies to improve these skills, one of which is relatively straightforward and achievable - integrating technology into the learning process (Lim *et al.*, 2020; Montiel *et al.*, 2020). This term is commonly referred to as the utilization of E-Learning during the learning process or in the learning itself that is technology-based (Rawashdeh et al., 2021).

By incorporating technology into the learning process, specifically through electronic-based learning or e-learning, we anticipate that it will genuinely aid students in acquiring the necessary competencies. It's well-known that e-learning offers substantial benefits for Vocational High School (SMK) students, particularly in developing soft skills outside of regular class time. Moreover, the utilization of online e-learning platforms has been empirically demonstrated to provide students with interactive and captivating content, thereby stimulating their curiosity and motivating them to explore subjects beyond the prescribed curriculum (Ramadhan et al., 2022). Irrespective of their geographical locations, e-learning empowers students effectively. This facilitates the exchange of valuable insights derived from diverse experiences and perspectives, thereby fostering the development of essential communication and cooperation skills that are indispensable for their future professional pursuits (Siron, Wibowo and Narmaditya, 2020; Tawafak *et al.*, 2021). E-learning encompasses various technological devices such as computers, smartphones, tablets, and laptops, among others (Zaheer et al., 2018). By integrating e-learning into their educational journey, students in vocational high schools (SMK) can enhance their comprehension and mastery of information technology skills, which are pivotal for their future endeavors. The incorporation of E-Learning into educational endeavors presents a multitude of benefits, regardless of whether it is utilized in an online or offline setting. The main illustration of online applications showed the characteristics of e-learning which are able to improve student skills and foster critical thinking abilities which are one of the 21st-century competencies (Rawashdeh et al., 2021).

To enhance the skills of vocational high school graduates and address the challenges they currently face, it is crucial to explore various aspects that can be leveraged through e-learning. It is clear that this research will play a crucial role in advancing the field of e-learning utilization during the learning process. By examining the interaction between different e-learning activities and learning achievements, policymakers at the educational unit level will be better equipped to develop effective technology integration policies for the learning process. Consequently, this study aimed to provide a comprehensive analysis of how the implementation of e-learning can support vocational school students in improving their skills, thereby mitigating the negative perceptions and unemployment issues associated with vocational high school graduates.

The research review will focus on formulating several research questions (RQ) that require thorough investigation and answers, which were; i) what types of e-learning are utilized during learning activities; ii) how is the impact of e-learning application on improving vocational school students' skills, iii) the types of competencies that can be improved as a provision for graduates to get a job through the application of e-learning.

2. Method

In this study, researchers used a systematic literature review method (Chiu et al., 2023), This research method is used to study various articles from scientific journals and books relevant to the research topic (Snyder, 2019). Desk research is a type of research that involves gathering information and data from various accessible sources to achieve its main objective, which is to identify the implementation of E-learning and its effect on enhancing the skills of vocational school students. The scope and topics of the research articles to be included in this systematic review are determined by the main goal of the research (Patel and Patel, 2019).

The investigation commenced by identifying pertinent articles on vocational education, E-Learning, and skills in various databases, including Google Scholar and Scopus. In this article, SLR denotes the chosen reporting items for systematic review and meta-analysis techniques (PRISMA) (Santhanasamy and Yunus, 2022; Zainal and Yunus, 2022). The target time period for searching published articles is from 2018 to 2023. The search criteria for relevant published articles used several keywords, namely: "Industry", "E-Learning", "Unemployment", "Computer", "Vocational School", "21st Century Skills", and "Education and Training".

After conducting keyword searches in several scientific journal databases, the next step involves filtering the results based on the inclusion and exclusion criteria of relevant research findings. The inclusion and exclusion criteria will be explained in detail in table 1.

Table 1: Inclusion and Exclusion Criteria from scientific publications

Inclusion Criteria	**Exclusion Criteria**
Published in English	Not published in English
Paper published in a reputable journal	Duplicate publication
Publications that focus on education, learning and vocational fields	Publications that have no relationship to research keywords
Open access publications	Publications that have restricted access
Papers published from 2018 to 2023	Publications that do not focus on education

In the meantime, the research will exclude articles that do not demonstrate a connection with the research variables in terms of their titles, abstracts, and keywords (Bhangu, Provost and Caduff, 2023). To streamline the process of searching for articles, the Publish or Perish version 8 application is employed as a medium for literature search on the Scopus database. This is achieved by inputting the API Key.

The findings from several databases were then analyzed with several stages, namely the four stages carried out by researchers are identification, screening, eligibility, and inclusion as a form of the PRISMA Technique (Purnama, Wilujeng and Jabar, 2023; Saputra, Murdino and Tohani, 2023). Subsequently, an examination of numerous chosen articles was undertaken to conduct a descriptive analysis and ascertain themes pertaining to the research focus. The findings of this study will be conveyed in a manner that facilitates comprehension for readers, while still upholding the primacy of scientific principles (Khatri, 2020).

This literature review research will have several steps. The initial stage begins by searching for articles in the Publish or Perish (PoP) application, followed by inputting specific keywords related to research methodology, exclusion criteria, and published article databases. Upon completion of the article exploration, a total of 2093

selected articles from various databases were identified. These articles then undergo a screening process based on predetermined exclusion criteria to ensure relevance to the research topic and eliminate duplicates. This process aims to identify articles that align with the criteria and research topic, facilitating optimal subsequent processing and selection stages. Following the screening phase, a total of 82 articles were singled out for further assessment of eligibility. Subsequently, the full text of these articles was assessed, leading to the identification of approximately 35 relevant articles corresponding to various keywords and research topics. The findings of this literature search are conveyed through the following PRISMA flow that present in figure 1.

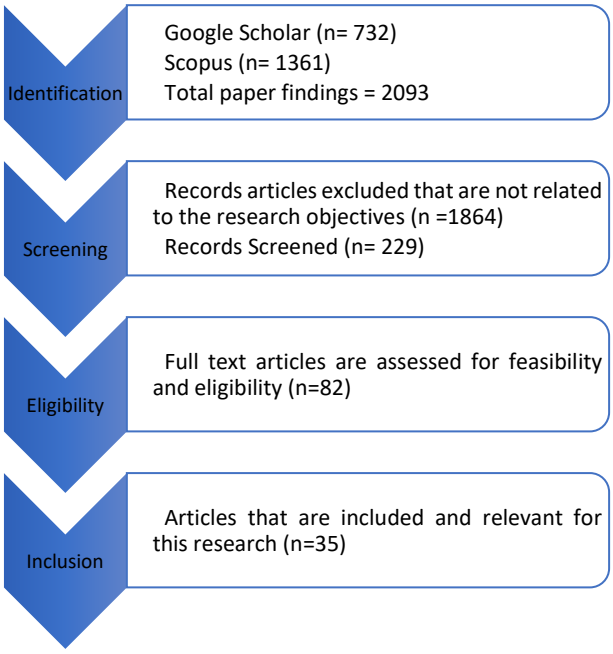

Figure 1: Analysis Using PRISMA Flow

3. Result and Discussions

Table 2 presents a summary of findings from various relevant articles obtained through the PRISMA process, serving as one of the data analysis methods for articles successfully retrieved from scientific publication databases such as Google Scholar and Scopus.

Table 2: Overview of Search Results and Article Evaluation

No.	Author	Methodology	Results	Skills Acquired
1.	Ansyari *et al.* (2021)	Research and Development	The findings from research and development show the evaluations done by experts in different areas. Material experts got a score of 87.5%, media experts got 95%, language experts got 83%, and information technology experts got a perfect score of 100%. Furthermore, small group trials with potential users resulted in a rating of 77%. The large group trial showed a percentage of 90%, indicating an improvement in assessment due to repeated explanations that helped students understand the story in online product promotion activities.	Communication & Product's Promotion Skills
2.	Dimache *et al.* (2018)	Qualitative	This study showed that IT skills of the students determine the way they perceive the system and the whole learning experience, as well as the level of knowledge acquired.	Practical Skills
3.	Aulia and Utami (2021)	Quantitative	Significant results were obtained that the use of e-learning by lecturers was able to increase student literacy as one of the skills needed in the 21st century.	Literacy Technology, Literacy Media, Critical Thinking, Creativity, and Collaboration
4.	Ebil, Salleh and Shahrill (2020)	Mixed Methods	Responses from students suggest that the practicality of implementing e-portfolios for TVET in Brunei may be influenced by teacher involvement, students' level of	Reflective thinking

No.	Author	Methodology	Results	Skills Acquired
			motivation, the specific e-portfolio software used, and the quality of existing connectivity.	
5.	Suryati, Suryana and Kusnendi (2019)	Quantitative	The findings of this study demonstrate that the schoology-based e-learning model and traditional learning models have a noteworthy impact on students' metacognitive thinking abilities. Nevertheless, several factors have been overlooked in this research as it primarily concentrates on the influence of the e-learning model on the 21st-century skills imparted to vocational school students.	Metacognitive skills
6.	Putri, Sumaryati and Jaryanto (2020)	Classroom Action Research	This research determines that the indicator of successful achievement of collaboration skills is 62.5%, which is in the good category. In pre-action, the percentage of collaboration skills indicators was 43.52% in the poor category; cycle I increased to 57.72% in the sufficient category; cycle II also increased to 72.84% in the good category. Based on this research, the SAVI learning model assisted by e-learning based Accounting Puzzles media can improve collaboration skills.	Collaborations Skills
7.	Rusnawati, Santyasa and Tegeh (2021)	Quantitative	Research findings indicate that there are disparities in both learning outcomes and critical thinking abilities when comparing students who utilize the project-based e-learning model with those who opt for the direct e-learning model. Additionally, this study reveals variations in critical thinking skills between students who engage in project-based e-learning and those who partake in direct e-learning.	Critical thinking Skills
8.	Rohendi, Wahyudin and Kusumah (2023)	Quantitative	The research results show that STEM-based media can improve vocational school students' mathematical abilities seen from students as a whole or based on student group level. Likewise, vocational school students' positive response to online learning using STEM-based media. This response means that students feel the benefits of online learning using STEM-based media.	Mathematics Abilities
9.	Darwin and Chaeruman (2022)	Quantitative	The findings indicated that the utilization of E-learning self-determination theory had a positive impact on enhancing students' listening abilities. This advantage can be attributed to its comparison with the traditional face-to-face approach. Moreover, the self-determination theory of E-learning offers greater flexibility as students can complete assignments or assessments at their convenience, regardless of location or time.	Listening Skills
10.	Yusuf and Widyaningsih (2020)	Qualitative	The research results showed that the quality of learning and students' metacognitive skills at each meeting increased. This is proven by research results which show that students fall into the good and very good categories. In conclusion, e-learning based virtual laboratory media is able to improve the quality of learning and develop the metacognitive skills of vocational school students in courses that require experimentation.	Metacognitive skills
11.	Kuatbekov *et al.* (2023)	Quantitative	Based on the findings of the self-assessment, the acquisition of digital skills has been enhanced through learning activities. The research has facilitated the identification of crucial factors that contribute to the advancement and reinforcement of contemporary media proficiencies within the realm of online education. It has been deduced that media literacy is an outcome of meticulously designed and effectively executed practical tasks undertaken by students in the digital media domain.	Media Literacy
12.	Mahmod Eyadat (2023)	Quantitative	It was found that the most serious challenges related to the use of technology were represented mainly in challenges related to technology implementation, challenges related to school capabilities, and challenges related to the curriculum. It was found that there were challenges that significantly affected student achievement.	Creative Thinking

No.	Author	Methodology	Results	Skills Acquired
			The hope is that through the use of ICT, students can achieve quite brilliant academic achievements, especially in skills that are really needed in the 21st century, such as creative thinking.	
13.	Hoerunnisa, Suryani and Efendi (2019)	Quantitative	The research results confirmed that the use of e-learning is able to increase student achievement and motivation significantly, besides that student participation in learning also tends to be active, this is due to the flexibility of e-learning which can be accessed at any time by students.	Motivation
14.	Bima, Saputro and Efendy (2021)	Research and Development	The research results show that the virtual laboratory for micro power plants has been empirically proven to be effective in supporting practical learning, especially during the Covid-19 pandemic.	Practical Skill
15.	Meidyrianto, Hamidah and Efendi (2022)	Research and Development	Through the use of PJBL animation media and portfolio assignments in class. The student competencies of SMK Negeri 7 Surakarata also showed very good results with a significance value of 0.05 from the four competencies studied, this shows the effectiveness of the PJBL model animation media and portfolio assignments when used during learning activities.	Cognitive and Practical Skill
16.	Sari, Susilawati and Anwar (2021)	Research and Development	The findings indicated that the developed e-module demonstrated high validity and feasibility for field testing, with an average material validation percentage of 91.69% and an average media validation percentage of 94.13%. Consequently, it can be concluded that the e-module for hydrocarbon compounds is exceptionally effective and captivating for implementation in a broader educational context.	Cognitive Skill
17.	Novaliendry *et al.* (2021)	Research and Development	Overall, the product from the research and development results in this research has obtained an assessment of the practicality of Android-based learning media as a learning resource of 88.46%, so the level of practicality can be interpreted as very practical to use. The assessment of the effectiveness of Android-Based Learning Media is 90.86%, so the level of significance can be interpreted as Very Good for use and is expected to be able to help students improve their understanding of the materials being studied.	Cognitive Skill
18.	Pipattanasuk and Songsriwittaya (2020)	Quantitative	The experimental group of students demonstrated significantly higher learning achievements compared to the control group, with a statistical significance level of .05. Additionally, the students expressed a high level of satisfaction with the instructional model. Consequently, it can be inferred that the utilization of augmented reality technology in the instructional model proved to be efficient and appropriate for the microcontroller foundation course designed for vocational certificate students.	Practical Skill
19.	Nugraha and Wahyono (2019)	Research and Development	The research results show that learning multimedia is suitable for use and contributes to students' psychomotor skills. The results of expert validation and product trial results were obtained with a minimum score range that had "good" criteria, so that the product being developed was said to be "viable".	Psychomotor
20.	Rachman *et al.* (2022)	Qualitative	The results of this research show that inquiry-based digital history books are needed by teachers as a means of providing critical thinking stimulus to vocational school students, as per the results of interviews conducted by social studies teachers.	Critical Thinking Skills
21.	Supianti *et al.* (2022)	Research and Development	This study showed that using Edmodo-assisted e-learning for teaching statistical materials is highly suitable for learning mathematics. Moreover, the application of these teaching materials has a positive impact on mathematical literacy skills, falling under the reasonably good category.	Mathematics Literacy

No.	Author	Methodology	Results	Skills Acquired
			Hence, it is important to enhance the teaching materials by incorporating animation, employing communicative language, and leveraging the latest technology.	
22.	Triyono, Muhtadi and Widowati (2022)	Research and Development	The results indicate that Android-based mobile media is very feasible. The empirical testing result also shows that the developed product can promote 21st century's competence such as creative thinking skills.	Creative thinking skills
23.	Sari Wahyuni and Haryani (2020)	Research and Development	The e-module was effective in improving students' critical thinking skills, with an N-gain of 0.57 in the medium category and 86.12% classical completeness. Students responded positively to the practicality of the e-module, with 77.78% rating it as very good and 22.22% as good. The student's worksheet was found to be valid, effective, practical, and capable of enhancing critical thinking skills.	Critical thinking skills
24.	Shdaifat, Shdaifat and Khateeb (2020)	Qualitative	Respondents in Jordan showed a lack of interest in using E-Learning apps for vocational education during the COVID-19 crisis. The challenges faced were found to be significant. Researchers suggest offering training courses to vocational education teachers in Jordan on how to effectively use E-Learning apps.	-
25.	Soub (2022)	Quantitative	A teacher's proficiency in online learning for vocational education falls within the medium to high range. Factors like education level and years of experience affect their skill level. The study highlights key challenges in vocational education, such as the e-learning platform and online resources constraints.	ICT Literacy
26.	Liu (2023)	Quantitative	Vocational schools have consistently prioritized the objective of securing employment as the focal point of education. Building upon this foundation, the present study aims to foster top-notch individuals by examining the English education in Higher Vocational Colleges within the cloud computing environment.	Language Literacy
27.	Pangeni and Karki (2021)	Quantitative	The study reported that e-learning was promising for the TVET sector as an innovative ICT integrated alternative pedagogy. However, teachers and schools want additional support for training and ICT infrastructures so that teachers can implement e-learning independently.	-
28.	Sirakaya and Cakmak (2018)	Quantitative	This result showed that Augmented Reality as an application can be effective in increasing learning outcomes.	self-efficacy
29.	Şeker, Bülbül and Erdinler (2022)	Quantitative	The study evaluated the demographic characteristics of the students, the opinions of Forest Industry Engineering Department students on their department, the opinions of Vocational School of Forestry students on their department, and the students' opinions about computer aided design programs. Furthermore, the study also assessed and interpreted the sectors in which the students aspire to work after graduation.	-
30.	Ma, Hwang and Shih (2020)	Quantitative	This research revealed that a machine learning-based peer tutor recommendation system (MPTRS) with automatic assessment is highly recommended for teachers to use, this is an effort by teachers to improve learning, especially on practical material for operating computer applications. This automated assessment system (AAS) utilizes computer vision technology to assess the results of student work and provide immediate suggestions or feedback.	Operating Skills
31.	He, Ratanaolarn and Sitthiworachart (2024)	Quantitative	Two experimental cases were implemented to obtain comparative data from two classes, testing the effect of gamification teaching on improving students' grades and stimulating their learning motivation.	Motivation
32.	Lee *et al.* (2022)	Quantitative	The performance of participants improved through the practice period with the experimental group showing	Motoric Skills

No.	Author	Methodology	Results	Skills Acquired
			significantly greater changes than those in the control condition. For the delayed-test, both groups declined to some extent from the post-test, but the experimental subjects did better comparatively.	
33.	Demir and Tavil (2021)	Mixed Methods	The results indicated that both technology-based materials and textbook-based materials helped listening skill development. Technology-based materials proved to be slightly more effective than textbook-based materials in quantitative results.	Listening Skills
34.	Deaconu *et al.* (2018)	Quantitative	The outcomes of our investigation have substantiated our initial suppositions, specifically the observation that employing ICT techniques in tourism courses enables students to comprehend and internalize specialized information more swiftly and effectively. Furthermore, it facilitates the cultivation and enhancement of distinct proficiencies at an elevated standard compared to conventional instructional approaches.	-
35.	Widyaningsih *et al.* (2020)	Research and Development	The findings indicated that the learning materials created were deemed valid in all areas of evaluation, including layout, navigation, functions, and pedagogy. Additionally, the students' reactions to the interactive multimedia employed were found to be both effective and practical across all aspects of assessment.	HOT Skills

3.1 Application of e-Learning Types in Different Countries and the Types of E-Learning Adopted (RQ-i)

Upon reviewing various literature, it is evident that e-learning is widely utilized across multiple countries, with diverse applications in each location. This diversity in the implementation of e-learning underscores its broad interpretation as a form of electronic-assisted learning (Garad, Al-Ansi and Qamari, 2021; Mursid, Muslim and Farihah, 2023). Therefore, the framework of thinking between researchers is certainly different and it becomes a fairness when the emphasis on the scope of e-learning is mentioned by the researchers.

Overall, e-learning is primarily utilized for vocational training, with some articles also noting its use in vocational higher education. Research conducted in various countries has revealed that the utilization of e-learning is highly diverse. In fact, it can be manifested in the form of a model or approach to learning, including the use of learning management systems, learning media, virtual laboratories, and other methods (Kuatbekov et al., 2023; Yusuf and Widyaningsih, 2020; Ma, Hwang and Shih, 2020). Several relevant studies consider the products they implement or develop to facilitate the learning process as electronic-based learning. It is interesting to note that, in general, we know that e-learning is a learning process that utilizes electronics, without specifying the type of electronics. This broad definition leaves room for interpretation by academics (Azmi and Widiaty, 2021). However, it is certain that the presence of e-learning will have a very vital role in creating a society of lifelong learners and addresses the accessibility and impact of e-learning for learners, especially in vocational high school (El-Sabagh, 2021). The analysis of research results on the implementation of different forms of e-learning across different regions has been effectively conducted and presented in table 3.

Table 3: Identify Types of e-Learning Usage in Different Countries

No.	E-Learning Types	Country	References
1.	Podcast	Indonesia	Ansyari *et al.* (2021)
2.	E-Learning (Model)	Ireland, Austria, Indonesia, Taiwan, Thailand	Dimache *et al.* (2018), Rusnawati, Santyasa and Tegeh (2021), Darwin and Chaeruman (2022), Ma, Hwang and Shih (2020), He, Ratanaolarn and Sitthiworachart (2024)
3.	Learning Management System (LMS)	Indonesia, Russia, Jordan, China, Nepal	Aulia and Utami (2021), Suryati, Suryana and Kusnendi (2019), Kuatbekov *et al.* (2023), Supianti *et al.* (2022), Shdaifat, Shdaifat and Khateeb (2020), Soub (2022), Liu (2023), Pangeni and Karki (2021)
4.	E-Portfolio	Brunei	Hj. Ebil, Salleh and Shahrill (2020)
5.	Learning Media	Indonesia, Turkey	Putri, Sumaryati and Jaryanto (2020), Rohendi, Wahyudin and Kusumah (2023), Mahmod Eyadat (2023), Meidyrianto, Hamidah and Efendi (2022), Sari, Susilawati and Anwar (2021), Novaliendry *et al.* (2021), Rachman *et al.* (2022),

No.	E-Learning Types	Country	References
			Triyono, Muhtadi and Widowati (2022), Demir and Tavil (2021), Widyaningsih *et al.* (2020)
6.	Virtual Laboratory	Indonesia	Yusuf and Widyaningsih (2020), Bima, Saputro and Efendy (2021)
7.	Multimedia	Indonesia	Hoerunnisa, Suryani and Efendi (2019), Nugraha and Wahyono (2019)
8.	Augmented Reality	Thailand, Turkey, Taiwan	Pipattanasuk and Songsriwittaya (2020), Sirakaya and Cakmak (2018), Lee *et al.* (2022)
9.	Computer Based	Turkey, Romania	Şeker, Bülbül and Erdinler (2022), Deaconu *et al.* (2018)

3.2 Impact of e-Learning Utilization on Students' Skill Improvement (RQ-ii)

E-learning, also known as electronic learning, is a method of acquiring knowledge that utilizes information and communication technology to electronically deliver learning materials. This educational approach encompasses the utilization of software, hardware, and online resources to facilitate access to learning content, regardless of whether one is connected to the internet or not (Mursid, Muslim and Farihah, 2023; Sirakaya and Cakmak, 2018).

E-learning in vocational high schools serves as a complementary tool, bridging the deficiencies in instructional resources and is recognized for its ability to enhance both theoretical and practical education (Naveed and Ahmad, 2019). Moreover, e-learning offers the opportunity to enhance the educational experience by offering additional resources, virtual assignments, and interactive simulations, all designed to strengthen the understanding of topics taught in conventional classroom settings (Ahn and Edwin, 2018).

Furthermore, electronic learning (e-learning) has the capability to act as a replacement for traditional learning activities. Through its diverse functionalities, e-learning can provide opportunities for self-directed learning, particularly beneficial for students who need alternative approaches to learning or encounter barriers to in-person instruction. As evidenced by (Cornelius and Gordon, 2022), e-learning is a flexible tool that supports educational endeavors in vocational high schools, extending beyond its classification solely as an online learning medium.

The study showed that e-learning had a favorable influence on students' academic accomplishments and abilities. Furthermore, e-learning played a significant role in enhancing 21st-century competencies, fostering learning motivation, and cultivating students' enthusiasm for education (Hoerunnisa, Suryani and Efendi, 2019). The evaluation of e-learning leads to better results than traditional learning methods, which do not fully utilize electronic technology (Pangeni and Karki, 2021).

Many studies have shown that e-learning approaches are very effective at improving the theoretical understanding of vocational school students (Yusuf and Widyaningsih, 2020; Meidyrianto, Hamidah and Efendi, 2022). Students' psychomotor and practical skills can also be improved using this method, according to several studies (Dimache *et al.*, 2018; Bima, Saputro and Efendy, 2021). Furthermore, research also conveys that e-learning plays a significant role in fostering the growth of essential skills required in the 21st century. These skills encompass creative thinking, critical thinking, digital literacy, media literacy, ICT literacy, metacognition, and listening skills within the linguistic domain (Suryati, Suryana and Kusnendi, 2019; Kuatbekov *et al.*, 2023).

Research on e-learning emphasizes the use of online features, particularly the Learning Management System (LMS). A study revealed that teachers implementing e-learning have successfully improved students' literacy skills, aligning with the requirements of 21st-century learning (Aulia and Utami, 2021). In Turkey, case studies have shown the utilization of augmented reality (AR) technology for offline e-learning purposes. It seems that the findings of this research indicate that augmented reality (AR) can be useful in raising students' cognitive achievement and enhancing their ability to assemble computers practically (Sirakaya and Cakmak, 2018).

It is evident from the numerous studies and Table 2 in the preceding subchapter that using e-learning, both online and offline, can give students access to a greater range of learning resources and make it simple for them to modify their learning process. Therefore, the school community and policy makers should always commit to enhancing the implementation of e-learning in vocational schools so that teachers can make sure that students have the comprehensive knowledge and skills necessary to tackle future difficulties.

3.3 21st-Century Competencies as Provision for Employment That can be improved Through the use of e-Learning (RQ-iii)

In several middle- or low-income nations, such as Indonesia, there is a relatively high percentage of young individuals who lead inactive lifestyles (Divayana, Suyasa and Widiartini, 2021). It is widely recognized across different nations that vocational education plays a crucial role in producing competent workers who can effectively meet the demands of the industrial sector. This holds true for Indonesia as well. Presently, the industry requires not only individuals who possess the necessary skills and competencies, but also those who can utilize their knowledge to enhance productivity in the workforce (Wagiran, Pardjono and Sofyan, 2020). Therefore, educators and policy makers must work together to support vocational high schools in their mission to guarantee that their graduates possess the skills and knowledge that employers demand.

In order to quickly land a job and launch a business, you need to be equipped with industry-specific skills and be careful when evaluating business opportunities (Mukhadis, Ulfatin and Putra, 2019; Nazira and Kartika, 2021). It is known that 21st century competencies play a central role in preparing vocational students for the changing world of work (Voogt and Roblin, 2012; Katyeudo and de Souza, 2022). Possessing essential skills like critical thinking, creativity, proficient communication, and collaboration lays a strong groundwork for students to excel and stand out in the job market (Sá *et al.*, 2021; Kwiatkowska and Wiśniewska-Nogaj, 2022). Pupils who possess early problem-solving abilities, digital literacy, and an understanding of the newest technologies will be more equipped to handle the demands of the workforce in the future. These abilities will be essential for overcoming obstacles and competing in the workplace.

Different research findings indicate that e-learning plays a significant role in enhancing the abilities and proficiencies of vocational high school students. These skills encompass the essential competencies required in the 21st-century, in addition to the academic skills acquired by students. Table 4 presents the outcomes of the analysis conducted on articles exploring the utilization of e-learning to improve the competence and skills of vocational school students.

Table 4: Summary of Contribution of E-Learning Utilization in Student Skill Improvement

No.	Skill/Competencies	References
1.	Communication & Product's Promotion Skills	Ansyari *et al.* (2021)
2.	Practical Skills	Dimache *et al.* (2018), Bima, Saputro and Efendy (2021), Pipattanasuk and Songsriwittaya (2020), Nugraha and Wahyono (2019), Ma, Hwang and Shih (2020), Lee *et al.* (2022)
3.	Literacy Technology, Literacy Media, Critical Thinking, Creativity, and Collaboration	Aulia and Utami (2021), Kuatbekov *et al.* (2023), Soub (2022)
4.	Reflective thinking	Hj. Ebil, Salleh and Shahrill (2020)
5.	Metacognitive skills	Suryati, Suryana and Kusnendi (2019), Yusuf and Widyaningsih (2020)
6.	Collaborations Skills	Putri, Sumaryati and Jaryanto (2020)
7.	Critical thinking Skills	Rusnawati, Santyasa and Tegeh (2021), Rachman *et al.* (2022), Sari Wahyuni and Haryani (2020)
8.	Mathematics Abilities	Rohendi, Wahyudin and Kusumah (2023), Supianti *et al.* (2022)
9.	Listening Skills	Darwin and Chaeruman (2022)
10.	Creative Thinking	Mahmod Eyadat (2023), Triyono, Muhtadi and Widowati (2022)
11.	Motivation	Hoerunnisa, Suryani and Efendi (2019), He, Ratanaolarn and Sitthiworachart (2024)
12.	Cognitive Skills	Meidyrianto, Hamidah and Efendi (2022), Sari, Susilawati and Anwar (2021), Novaliendry *et al.* (2021), Widyaningsih *et al.* (2020)
13.	Language Literacy	Liu (2023), Demir and Tavil (2021)
14.	self-efficacy	Sirakaya and Cakmak (2018)

Upon examining the results of numerous pertinent studies, it is evident that e-learning plays an important role that should not be undervalued. This is because e-learning has been shown to assist students in gaining a variety of competencies or skills that are essential in the 21st century, including multiple literacies, teamwork, critical thinking, creative thinking, and mathematical proficiency (Rohendi, Wahyudin and Kusumah, 2023; Mahmod Eyadat, 2023). As an example It is well known that e-learning-based learning can support a variety of competencies that are needed. Furthermore, it is indisputable that the workforce requires certain competencies, like teamwork, creativity, and individual literacy (Yondri *et al.*, 2020; Rahmadhani, Ahyanuardi and Suryati, 2022), Hence, the utilization of e-learning in vocational secondary education is anticipated to achieve greater efficiency and encompass a wider range of educational institutions.

Furthermore, another important aspect that needs attention from the research findings above is that many studies reveal that e-learning implemented in vocational education has a significantly positive impact on students' skill achievement (Pipattanasuk and Songsriwittaya, 2020). This outcome has not been widely explored in the context of vocational high schools. It is undeniable that the impact of implementing e-learning in the field of education is highly positive for enhancing skills and producing skilled graduates. Through the identification of literature, it is hoped that teachers, as well as education and vocational practitioners, can gain a more comprehensive understanding of the utilization of e-learning as a bridge to enhance both academic and non-academic skills of students.

Teachers and school-level policy makers can rest assured that they need not be concerned about funding and infrastructure of top-notch quality. The findings of this research indicate that e-learning can be defined as a form of education that makes use of digital learning tools in diverse formats, tailored to the specific attributes of the subject matter (Demir and Tavil, 2021; Widyaningsih *et al.*, 2020), to avoid simply adhering to the notion that e-learning is computer-based learning and that these devices need to be linked to the internet and paired with learning management systems.

4. Conclusion and Suggestions

According to some research findings, present-day Vocational High Schools integrate e-learning into their corresponding programs into two main types. Firstly, the web-based learning tool has Learning Management Systems (LMS) built into it and which is synthesized into the various learning processes. Another variety of online learning tools which is offline-accessible and includes various types of learning media like augmented reality, digital books, e-module, multimedia, android smartphones and computer-based applications comes within this type of e-learning technology. The application of e-learning has been tailored to the needs analysis and characteristics of the material. According to the result of this research, many studies have shown that the implementation of e-learning has a predominantly positive impact on student achievement in cognitive, psychomotor, and affective domains. In some cases, e-learning has even been found in several countries which apply it to learning activities that could enhance vocational school students' 21st-century soft skills, including technological literacy, media literacy, digital literacy, creative thinking, critical thinking, metacognitive skills, language literacy, and self-efficacy. The ultimate goal of the implementation of e-learning in any kind of form was to facilitate vocational school graduates in equipping the necessary skills that are needed in the 21st century.

The synthesis of this research review leads to several recommendations for future research, including conducting experiments to determine how applying e-learning affects students' attainment of 21st-century competencies and how easy it is for graduates to find employment. Additionally, researchers are encouraged to repeat systematic literature reviews on additional databases of indexed scientific articles both nationally and internationally using the provided keywords.

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