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Digital Ethics Among Vocational High School Students: A Systematic Literature Review of Emerging Issues And Educational Practices

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ABSTRACT

This study aimed to analyze the development of research on digital ethics among vocational high school students through a Systematic Literature Review (SLR) based on bibliometric analysis. The study focused on identifying publication trends and bibliometric characteristics, examining major contributors and geographical distributions, and exploring the main themes, emerging issues, and educational practices within the field. Data were collected from the Scopus database using predefined keywords related to digital ethics, digital citizenship, digital literacy, and vocational education, resulting in 37 articles published between 2019 and 2025. Data analysis employed the Analyze Search Results feature in Scopus and VOSviewer software through co-occurrence, overlay, and density visualizations. The findings revealed a growing trend in publications, with Indonesia emerging as the most productive contributor. Furthermore, the intellectual structure of the field has evolved from traditional themes centered on digital literacy and vocational education toward broader issues involving digital citizenship, digital transformation, responsible technology use, and emerging educational practices. These findings indicate that digital ethics has become an essential component of twenty-first-century competencies and technology-supported learning environments in vocational education.

Keywords: citizenship; ethics; literacy; vocational

INTRODUCTION

The rapid development of digital technology has transformed almost every aspect of human life, including education. The expansion of internet access, social media platforms, artificial intelligence, and digital learning environments has created new opportunities for improving educational quality and expanding access to knowledge. At the same time, these technological developments have also generated various ethical challenges associated with responsible technology use, digital citizenship, privacy, online behavior, and information literacy. Consequently, digital ethics has become an increasingly important issue in contemporary education, particularly in preparing students to become responsible participants in the digital society. Within this context, digital ethics refers to the values, norms, and behaviors that guide individuals in using digital technologies responsibly, safely, and ethically. As educational institutions continue to integrate digital technologies into teaching and learning processes, developing students' digital ethics has become an essential component of twenty-first-century competencies.

Vocational education occupies a strategic position in preparing skilled human resources capable of responding to the changing demands of the labor market. Unlike general education, vocational education emphasizes practical competencies, employability skills, and industry-oriented learning experiences. The growing digitalization of workplaces and industrial

processes has increased the importance of digital competence and ethical technology use among vocational students. In addition to mastering technical skills, vocational high school students are expected to possess digital literacy, critical thinking, collaboration, communication, and responsible digital behavior to succeed in increasingly technology-driven environments. Consequently, digital ethics is no longer viewed merely as a matter of online etiquette but as an important element supporting students' employability, lifelong learning, and participation in digital society.

The emergence of Industry 4.0 and Society 5.0 has further strengthened the significance of digital ethics in vocational education. Technological innovations, including artificial intelligence, big data, cloud computing, virtual reality, and the Internet of Things, have transformed educational practices and workplace environments. These transformations require vocational students to develop not only digital competencies but also ethical awareness regarding the use of technology. Responsible digital participation, information evaluation, cybersecurity awareness, and digital citizenship have become critical competencies for navigating increasingly complex digital ecosystems. Therefore, educational institutions are expected to cultivate digital ethics through innovative pedagogical approaches and technology-enhanced learning environments.

Previous studies have emphasized the importance of digital literacy and digital competence in vocational education. Research conducted by Sari et al. (2020), Mutohhari et al. (2021), and Ninghardjanti and Dirgatama (2021) demonstrated that digital literacy plays a significant role in improving vocational students' readiness to engage effectively in digital learning environments. Similarly, studies by Soeprijanto et al. (2022), Sutiman et al. (2022), Kholifah et al. (2022), and Kholifah et al. (2023) highlighted the contribution of digital competencies to employability, entrepreneurial intentions, and career readiness among vocational students. These findings indicate that digital ethics and digital literacy are increasingly recognized as essential factors in supporting the successful transition of vocational graduates into the digital economy.

In addition, recent studies have focused on the integration of digital technologies into vocational education. Yan and Liu (2022), Wang et al. (2023), and Zong (2023) emphasized the role of digital transformation in reshaping vocational learning environments and promoting digital citizenship. Research conducted by Hoaihongthong et al. (2024), Habibi et al. (2024), Chen and Chan (2024), and Mulyanti et al. (2024) highlighted the importance of teachers' digital competence and technology-enhanced pedagogies in fostering responsible digital participation. Furthermore, studies by Ding et al. (2024), Liu and Sang (2024), Wang and Cao (2024), and Zervas and Stiakakis (2024) illustrated how emerging technologies and digital ecosystems are influencing learning experiences and ethical considerations in vocational education. More recent investigations have explored augmented reality, metaverse applications, digital entrepreneurship, and immersive learning environments as new directions in vocational education (Kamaruzaman et al., 2025a; Ahmad et al., 2025; Ma et al., 2025; Regassa & Desissa, 2025; Swaramarinda et al., 2025; Widaningsih et al., 2025).

Despite the growing body of literature, previous studies have largely focused on specific aspects of digital literacy, digital competence, technology integration, or pedagogical innovation. Most investigations have examined digital ethics indirectly and within limited contexts. Existing studies are generally fragmented and tend to emphasize particular technologies or educational interventions rather than providing a comprehensive understanding of how research on digital ethics among vocational high school students has evolved. Information concerning publication trends, major contributors, geographical distributions, and the intellectual structure of the field remains scattered across different studies. Consequently, it remains difficult to identify the dominant themes, emerging issues, and educational practices that characterize the development of digital ethics research in vocational education.

Furthermore, bibliometric studies specifically addressing digital ethics among vocational high school students remain relatively limited. Previous reviews have primarily adopted traditional literature review approaches, focusing on synthesizing findings without systematically mapping the intellectual landscape of the field. However, bibliometric analysis offers a more comprehensive approach for examining research development by identifying publication trends, productive authors, institutional contributions, geographical distributions, and thematic relationships among keywords (Donthu et al., 2021). In particular, the use of visualization tools such as VOSviewer enables researchers to explore research clusters, emerging themes, and intellectual structures that shape the evolution of a field (Van Eck & Waltman, 2010). Therefore, a significant research gap exists regarding the lack of comprehensive bibliometric mapping of digital ethics research among vocational high school students.

To address this gap, the present study employs a Systematic Literature Review (SLR) combined with bibliometric analysis to examine the development of research on digital ethics among vocational high school students. Specifically, this study aims to identify publication trends and bibliometric characteristics, analyze the leading contributors and geographical distribution of research, and explore the major themes, emerging issues, and educational practices through VOSviewer visualization. By providing a comprehensive overview of the intellectual structure of the field, this study contributes to a deeper understanding of how digital ethics research has evolved within vocational education.

Accordingly, this study addresses three research questions: (1) What are the publication trends and bibliometric characteristics of studies on digital ethics among vocational high school students? (2) Who are the leading contributors and how are the geographical distributions of studies on digital ethics among vocational high school students? and (3) What are the major themes, emerging issues, and educational practices in studies on digital ethics among vocational high school students? The findings are expected to provide theoretical contributions to the growing literature on digital ethics and practical implications for educators, policymakers, and researchers in developing ethical, responsible, and technology-supported learning environments that prepare vocational students for the challenges of Industry 4.0 and Society 5.0.

METHODS

This study employed a Systematic Literature Review (SLR) approach based on bibliometric analysis to map the development of research on digital ethics among vocational high school students. This approach enables the systematic and measurable identification of publication trends, research characteristics, and the intellectual structure of the field (Kitchenham & Charters, 2007; Donthu et al., 2021). Data were collected from the Scopus database using the search query: TITLE-ABS-KEY (("digital ethics" OR "digital citizenship" OR "digital literacy") AND ("vocational education" OR TVET OR "vocational school*")). The search was limited to publications from 2019 to 2025 and initially yielded 114 documents. Subsequently, filtering procedures were applied based on relevant subject areas and document eligibility, resulting in 37 articles that were used as the data sources for the analysis.

Data analysis was conducted descriptively using the Analyze Search Results feature in Scopus and VOSviewer software. Scopus analysis was employed to identify publication characteristics based on publication year, document type, source title, author, affiliation, country or territory, and subject area. Furthermore, VOSviewer was used to visualize the intellectual structure of the field through co-occurrence analysis, overlay visualization, and density visualization to identify relationships among keywords, research clusters, emerging issues, and educational practices related to digital ethics among vocational high school

students (Van Eck & Waltman, 2010; Donthu et al., 2021). The findings were subsequently presented in the form of graphs and visualization maps and interpreted descriptively to provide insights into research developments and future directions in the field of digital ethics and educational practices in vocational education.

RESULT AND DISCUSSION

To answer the first research question concerning the publication trends and bibliometric characteristics of studies on digital ethics among vocational high school students, an analysis was conducted using the Analyze Search Results feature in the Scopus database. This analysis aims to provide an overview of the development and characteristics of publications in this field during the 2019–2025 period. Bibliometric analysis enables the identification of publication growth patterns and provides information regarding document types, publication sources, and subject areas that have contributed to the development of research on digital ethics and educational practices in vocational education. Accordingly, the bibliometric characteristics of the selected studies were examined through four indicators, namely documents by year, documents by type, documents by source, and documents by subject area. The results of these analyses are presented in the following figures.

What are the publication trends and bibliometric characteristics of research on digital ethics among vocational high school students?

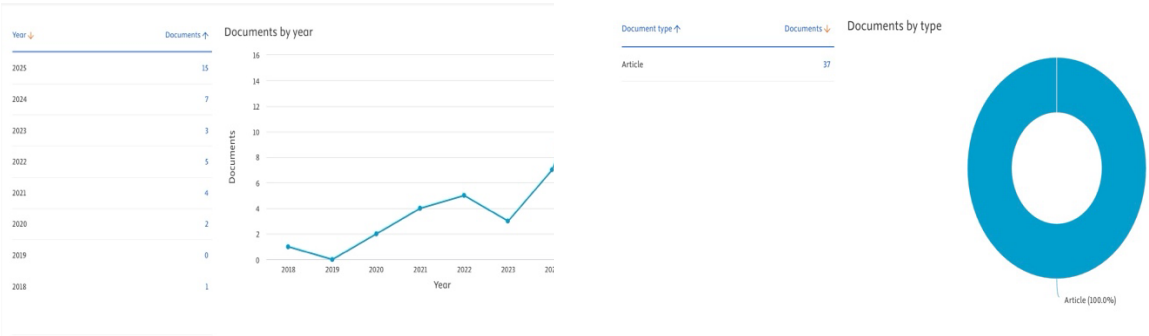

Figure 1: Documents by Year and by Type
Source: Scopus database, 2026

Figure 1 illustrates the publication trends and document types of studies on digital ethics among vocational high school students based on the 37 articles analyzed during the 2019–2025 period. Overall, the number of publications exhibits a fluctuating pattern but shows a noticeable increase in recent years. Research output remained relatively limited during the early years, followed by a gradual increase and reaching its highest level in 2025. In addition, the analysis of document types reveals that all publications included in this study were journal articles (100%), indicating that research on digital ethics in vocational education has primarily been disseminated through peer-reviewed journals. This finding suggests that the field has developed through studies with relatively high scientific rigor and methodological quality.

The increasing publication trend reflects the growing attention given to digital ethics issues in vocational education, particularly in response to the rapid expansion of digital technologies and the demands of twenty-first-century learning. Earlier studies focused on digital literacy, online learning readiness, and technology-mediated learning environments (Smith & Sadler-Smith, 2003; Moore et al., 2011; Means et al., 2013; Quesada-Pallares et al.,

2019). As digital transformation accelerated, research increasingly addressed learner engagement, self-regulated learning, and the role of digital competencies in supporting academic performance (Rajabalee & Santally, 2021; Ng, 2021; Ye et al., 2022; Loock et al., 2022). More recent studies have expanded the discussion toward digital citizenship, digital transformation, and artificial intelligence in vocational education (Yan & Liu, 2022; Wang et al., 2023; Zong, 2023; Ding et al., 2024; Liu & Sang, 2024; Wang & Cao, 2024; Chen & Feng, 2024). These developments indicate that research on digital ethics has evolved from issues related to digital literacy and learning readiness toward broader concerns involving responsible technology use, digital citizenship, and ethical implications of emerging technologies in vocational education.

The dominance of journal articles further demonstrates that research on digital ethics among vocational high school students is supported by empirical and evidence-based investigations. Previous studies have emphasized the importance of digital literacy as a prerequisite for effective learning and responsible participation in digital environments (Martin, 2006; Martinez-Bravo et al., 2020). Furthermore, recent studies highlight the significance of teachers' digital literacy, digital transformation, and the integration of artificial intelligence in educational processes (Yan & Liu, 2022; Wang et al., 2023; Chen & Feng, 2024; Ding et al., 2024). Consequently, the increasing publication trend and the predominance of journal articles suggest that digital ethics has emerged as an important area of research in vocational education and is likely to continue expanding alongside technological advancements and the increasing emphasis on responsible digital citizenship in the era of Industry 4.0 and Society 5.0.

Figure 2: Documents per Year by Source and by subject area
Source: Scopus database, 2026

The analysis presented in Figure 2 indicates that studies on digital ethics among vocational high school students are distributed across a variety of international journals, reflecting the broad and multidisciplinary nature of this research area. Several journals contributed more than one publication, while many others contributed a single article, demonstrating that research on digital ethics and related educational practices is not concentrated in a single publication outlet. The diversity of publication sources suggests that digital ethics in vocational education has attracted attention from scholars working in different domains, including vocational education, educational technology, digital competence, and twenty-first-century skills. This also indicates that the topic has emerged as an increasingly important area of inquiry in response to the rapid digital transformation affecting vocational education systems worldwide.

Furthermore, the analysis by subject area reveals that the field is predominantly situated within the Social Sciences, followed by contributions from Computer Science, Engineering, and other related disciplines. The predominance of Social Sciences suggests that research on

digital ethics among vocational high school students largely focuses on pedagogical issues, digital behavior, digital citizenship, digital competence, and the development of twenty-first-century skills. Previous studies have emphasized the importance of digital literacy and digital ethics as essential competencies for vocational learners in the digital era (Sari et al., 2020; Yildiz, 2020; Mutohhari et al., 2021; Ninghardjanti & Dirgatama, 2021). In addition, research has highlighted the challenges associated with implementing twenty-first-century competencies and fostering critical thinking skills through technology-supported learning environments (Papier, 2021; Shukshina et al., 2021; Kholifah et al., 2022). Studies also demonstrate that digital literacy significantly influences learning achievement, career decision-making, and entrepreneurial competencies among vocational students (Soeprijanto et al., 2022; Sutiman et al., 2022; Kholifah et al., 2023; Jatmoko et al., 2023).

The increasing contribution from Computer Science and Engineering reflects a shift in research attention toward technology-enhanced educational practices and digital transformation within vocational education. Several studies have investigated e-learning readiness and the integration of digital learning platforms in vocational settings (Loock et al., 2022; Schlebusch & Manyarela, 2024). Others have focused on digital pedagogy, digital competence standards, and technology integration to support teaching and learning processes (Chen & Chan, 2024; Mulyanti et al., 2024; Zervas & Stiakakis, 2024; Widaningsih et al., 2025; Regassa & Desissa, 2025). Recent studies further demonstrate that emerging technologies, such as augmented reality and the metaverse, are becoming increasingly relevant to vocational education and digital learning environments (Kamaruzaman et al., 2025a; Ahmad et al., 2025). Likewise, research concerning multidimensional assessment models and digital entrepreneurship education illustrates how technological innovations are reshaping vocational learning and preparing students for participation in the digital economy (Ma et al., 2025; Swaramarinda et al., 2025).

The diversity of subject areas also indicates that digital ethics is no longer viewed solely as an educational issue but has evolved into a broader interdisciplinary concern involving employability, digital inclusion, and lifelong learning. Studies have highlighted the role of digital literacy in bridging employability gaps and preparing vocational graduates for rapidly changing labor markets (Tomczak et al., 2023; Bahçekapili et al., 2025). Similarly, research on digital competencies among vocational teachers and students demonstrates the importance of equipping both educators and learners with ethical and responsible digital capabilities (Hoaihongthong et al., 2024; Habibi et al., 2024; Ismail et al., 2025). Other investigations have explored the implications of digital inclusion, self-optimization, and the digital economy for vocational learners and society at large (Smit et al., 2025; Swaramarinda et al., 2025). These findings indicate that digital ethics is increasingly interconnected with broader issues related to social participation, technological innovation, and workforce readiness.

Overall, the distribution of publication sources and subject areas demonstrates that research on digital ethics among vocational high school students has evolved into a highly interdisciplinary field. While Social Sciences remain the dominant discipline, growing contributions from Computer Science, Engineering, and technology-related fields suggest a gradual shift from traditional discussions of digital literacy and digital behavior toward more comprehensive concerns involving digital transformation, digital competence, and emerging educational practices. Consequently, the bibliometric characteristics identified in this study indicate that research on digital ethics is increasingly oriented toward supporting responsible digital citizenship, enhancing digital competencies, and preparing vocational students to meet the demands of Industry 4.0 and Society 5.0.

Who are the main contributors and how is the geographical distribution of research on digital ethics in vocational high school students?

To answer the second research question concerning the main contributors and geographical distribution of research on digital ethics among vocational high school students, an analysis was performed using the Analyze Search Results feature in Scopus. This analysis aims to identify the most productive authors, leading institutions, and countries that have contributed to the development of this field. Examining author productivity, institutional affiliations, and geographical distribution is important for understanding the major centers of research and the extent to which studies on digital ethics have gained international attention. Furthermore, this analysis provides insights into the collaborative and interdisciplinary nature of the field and highlights the regions and institutions that play a significant role in advancing research on digital ethics and educational practices in vocational education. The results of the analysis based on authors, affiliations, and countries or territories are presented in the following figure.

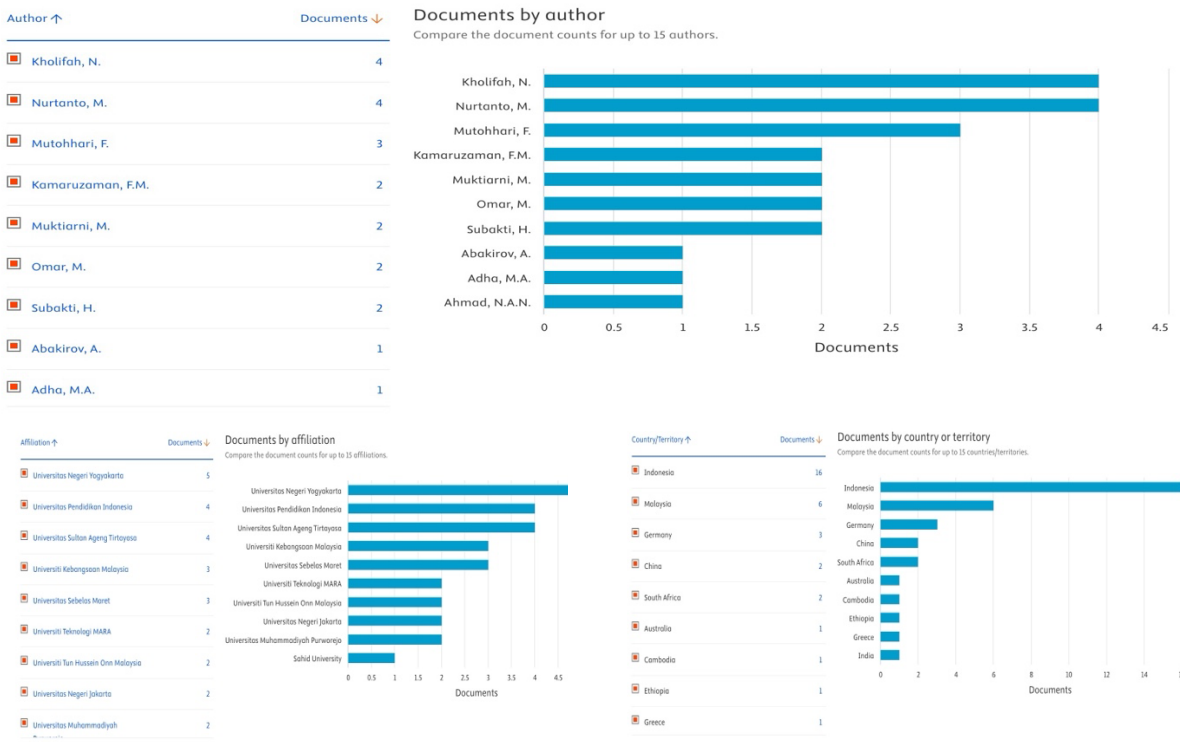

Figure 3: Documents by author, afiliation and by country or territory
Source: Scopus database, 2026

Analysis based on author productivity shows that Kholifah, N. is the most productive author with four publications, followed by Nurtanto, M. with three publications. Several other authors, including Mutohhari, F., Komaro, M., and Mulyanti, B., contributed two publications each, whereas the remaining authors contributed one or two articles. In terms of institutional affiliation, Universitas Negeri Yogyakarta and Universitas Pendidikan Indonesia emerge as the leading institutions, followed by several other universities and vocational education institutions that have made significant contributions to this field. Regarding geographical distribution, Indonesia occupies the first position with the highest number of publications, followed by Malaysia, while countries such as China, Australia, South Africa, Germany, and several others contribute a smaller number of studies. The dominance of Indonesian authors,

institutions, and publications indicates that Southeast Asia, particularly Indonesia, has become one of the major centers for research on digital ethics among vocational high school students. This pattern also reflects the increasing attention given to issues related to digital literacy, digital citizenship, and responsible technology use within vocational education contexts.

The contributions of these leading scholars and institutions primarily focus on digital literacy development, digital competence, and educational practices that support ethical behavior in digital environments. Previous studies have emphasized the importance of digital literacy in strengthening vocational students' readiness to participate effectively in the digital era (Sari et al., 2020; Mutohhari et al., 2021; Ninghardjanti & Dirgatama, 2021). Other investigations have explored the role of digital competence in supporting entrepreneurial intentions, career development, and employability among vocational students (Soeprijanto et al., 2022; Sutiman et al., 2022; Kholifah et al., 2022; Kholifah et al., 2023; Jatmoko et al., 2023). Furthermore, studies have highlighted the importance of teachers' digital competence and the integration of technology-enhanced pedagogies to foster responsible digital participation among learners (Hoaihongthong et al., 2024; Habibi et al., 2024; Mulyanti et al., 2024; Chen & Chan, 2024). These findings suggest that digital ethics is increasingly perceived not merely as an issue of online behavior, but also as a critical component of vocational students' competencies and their preparedness for the demands of the digital economy.

Moreover, the diversity of countries and institutions involved demonstrates that research on digital ethics among vocational high school students has expanded beyond national boundaries and developed into an international and interdisciplinary field. Recent studies reveal a shift from conventional discussions of digital literacy toward broader themes associated with digital transformation, digital inclusion, and emerging technologies in vocational education (Tomczak et al., 2023; Yan & Liu, 2022; Wang et al., 2023; Zong, 2023). More recent contributions have examined the implications of artificial intelligence, digital ecosystems, and immersive technologies for vocational learning and ethical digital practices (Ding et al., 2024; Liu & Sang, 2024; Wang & Cao, 2024; Schlebusch & Manyarela, 2024; Zervas & Stiakakis, 2024). Studies published in 2025 further indicate increasing attention to digital entrepreneurship, augmented reality, metaverse technologies, and self-optimization within vocational education (Kamaruzaman et al., 2025a; Ahmad et al., 2025; Ma et al., 2025; Regassa & Desissa, 2025; Swaramarinda et al., 2025; Widaningsih et al., 2025). Overall, these findings indicate that research on digital ethics among vocational high school students is evolving into a global, collaborative, and multidisciplinary field, with increasing emphasis on digital citizenship, responsible technology use, and the development of competencies required for Industry 4.0 and Society 5.0.

What are the main themes, emerging issues, and educational practices that emerge in research on digital ethics in vocational high school students?

To answer the third research question concerning the main themes, emerging issues, and educational practices in studies on digital ethics among vocational high school students, an analysis was conducted using VOSviewer version 1.6.20. This analysis aims to identify relationships among concepts, map thematic clusters, and illustrate the evolution of topics that characterize this field of study. The intellectual structure of the literature was examined through three complementary visualizations. Co-occurrence analysis was used to identify the relationships among keywords and determine the dominant themes within the field. Furthermore, overlay visualization was employed to reveal the temporal evolution and emerging trends of research topics, while density visualization was used to identify the intensity and concentration of research activities on specific themes. Together, these analyses provide a comprehensive overview of the intellectual landscape, emerging issues, and

educational practices that have shaped the development of digital ethics research in vocational education. The results of the VOSviewer visualizations are presented in the following figure.

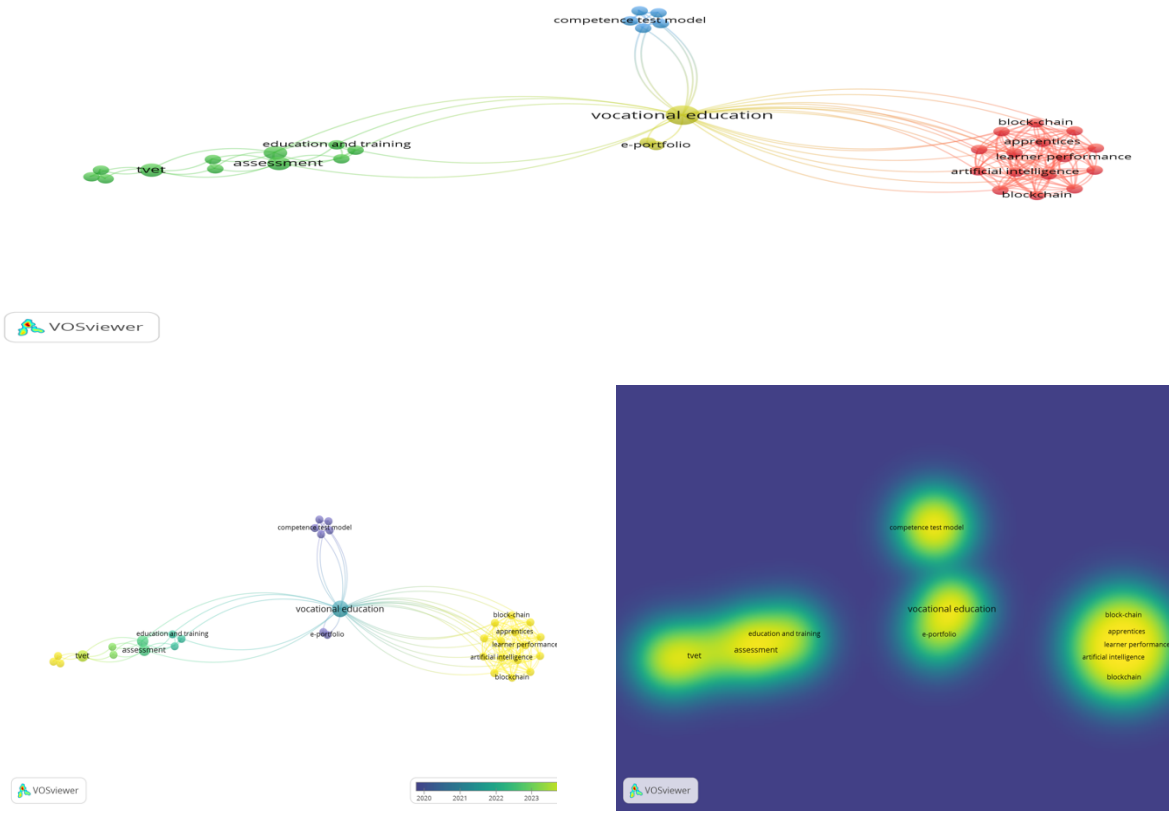

Figure 4: Co-occurrence of keywords , Overlay visualization, and Density visualization
Source: VOSViewer Output, 2026

Analysis using VOSviewer through keyword co-occurrence, overlay visualization, and density visualization reveals that research on digital ethics among vocational high school students has developed into several interconnected thematic clusters. The keyword "vocational education" appears as the central node linking various research themes, indicating that vocational education serves as the foundation for discussions related to digital ethics and educational practices. The green cluster is dominated by keywords such as digital literacy, TVET, and assessment, which represent the early emphasis on digital competencies and the integration of information technology into vocational learning. Another cluster includes themes related to education and training, while a more recent cluster highlights issues associated with learner performance and digital transformation. The strong interconnection among these keywords suggests that research initially focused on enhancing students' digital competencies and preparing vocational learners to participate effectively in technology-mediated environments. These findings are consistent with studies emphasizing the importance of digital literacy and digital competence as essential components of vocational education (Sari et al., 2020; Mutohhari et al., 2021; Ninghardjanti & Dirgatama, 2021; Soeprijanto et al., 2022).

The results of overlay visualization indicate a clear evolution of research themes between 2020 and 2025. Earlier studies were primarily associated with themes related to digital literacy, TVET, and the development of students' digital competencies. Such themes emphasized the importance of equipping vocational students with the skills necessary to adapt to digital learning environments and labor market demands (Kholifah et al., 2022; Sutiman et al., 2022; Kholifah et al., 2023). Over time, the focus of research shifted toward more contemporary

issues associated with digital citizenship, digital transformation, responsible technology use, and the integration of advanced technologies in vocational education. Recent studies increasingly explore digital inclusion, digital ecosystems, and technology-enhanced pedagogical practices (Yan & Liu, 2022; Wang et al., 2023; Zong, 2023; Tomczak et al., 2023; Hoaihongthong et al., 2024; Habibi et al., 2024). Furthermore, emerging themes involving artificial intelligence, immersive learning environments, and digital entrepreneurship demonstrate that research on digital ethics has expanded beyond basic digital literacy toward broader concerns regarding ethical participation in digital society (Ding et al., 2024; Liu & Sang, 2024; Wang & Cao, 2024; Chen & Chan, 2024; Mulyanti et al., 2024; Zervas & Stiakakis, 2024). These developments indicate that educational practices in vocational schools are increasingly influenced by technological innovation and the need to cultivate responsible digital behavior among students.

The density visualization further highlights the intensity and frequency of research topics within this field. High-density areas are concentrated around keywords related to digital literacy, vocational education, and associated educational practices, indicating that these themes remain the intellectual core of the literature. Nevertheless, newer themes characterized by digital transformation and emerging technologies are gradually gaining prominence. Recent studies have discussed augmented reality, metaverse applications, digital entrepreneurship, self-optimization, and the role of digital ecosystems in vocational learning (Kamaruzaman et al., 2025a; Ahmad et al., 2025; Ma et al., 2025; Regassa & Desissa, 2025; Swaramarinda et al., 2025; Widaningsih et al., 2025). Overall, the combined results of the three visualizations demonstrate that research on digital ethics among vocational high school students has evolved from a primary concern with digital literacy and digital competence toward a broader and more sophisticated intellectual structure encompassing digital citizenship, responsible technology use, and emerging educational practices. These findings suggest that future research will increasingly focus on the ethical implications of digital transformation and the development of adaptive, technology-supported learning environments that prepare vocational students for the challenges of Industry 4.0 and Society 5.0.

CONCLUSION

Based on the bibliometric analysis of 37 Scopus-indexed articles, it can be concluded that research on digital ethics among vocational high school students has shown a growing publication trend and is predominantly disseminated through journal articles across various disciplines, particularly Social Sciences and Computer Science, reflecting the increasingly interdisciplinary nature of this field. In terms of contributors, the development of research is concentrated among several leading authors, institutions, and countries, with Indonesia emerging as the major contributor, highlighting the significant attention given by Southeast Asian countries to issues related to digital ethics and educational practices in vocational education. Furthermore, the VOSviewer analysis reveals that the intellectual structure of the field has evolved from traditional themes centered on digital literacy, assessment, and vocational education toward more contemporary topics associated with digital citizenship, digital transformation, responsible technology use, and emerging educational practices. The overlay and density visualizations indicate that recent studies have increasingly focused on advanced technologies and their implications for vocational learning environments.

Therefore, the main finding of this study is that research on digital ethics among vocational high school students has undergone a substantial transformation from a primary emphasis on digital literacy and basic digital competencies to a broader concern with digital citizenship, ethical participation in digital environments, and technology-supported educational practices.

This transformation demonstrates that digital ethics is no longer viewed merely as an issue of responsible online behavior, but rather as an essential component of twenty-first-century competencies required by vocational students. The findings suggest that future research will increasingly explore the ethical implications of digital transformation, artificial intelligence, immersive technologies, digital ecosystems, and responsible technology use in order to support adaptive learning environments and prepare vocational students for the challenges of Industry 4.0 and Society 5.0.

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