CHAPTER V

DISCUSSIONS

The discussion section will thoroughly analyze the results and findings, emphasizing how they corroborate, compare with, or even confirm previous qualified studies. It highlights several key outcomes related to the study's objectives in this dissertation. The primary aim of this research is to develop a new framework for digital competence tailored for educators. Specifically, this study concentrates on vocational educators, revising and enhancing the previous digital competence framework to produce a new version tailored to this group.

5.1 The Existing Position of Digital Competence in Vocational Education

Previous studies on digital competence surged due to increased technology use during COVID-19. However, not all research addresses the complexity of integrating technology in vocational education, despite the high demand for digital skills among vocational educators. Therefore, because most research on digital competence has focused on general education, the current study chose to explore its connection to vocational education to gain deeper analysis of technology in vocational education, the needs and the challenges (Cattaneo et al., 2022c; Gündüzalp, 2021b; Miguel-Revilla et al., 2020; Tomczyk, 2019b; Zhao et al., 2021). Although vocational high schools in Indonesia enroll a significantly larger number of students, this issue has garnered comparatively limited scholarly attention in recent years. Furthermore, many educators within these institutions have not fully embraced digital competence as a fundamental skill. This encompasses areas such as digital safety, socio-emotional skills in digital contexts, and digital content reproduction (Komlayut & Srivatanakul, 2017). Similar to regular secondary education, higher education offers several relevant programs that focus on and evaluate these competences literacies (Olmeda-Gómez et al., 2017) also found the correlations between information literacy and VHS.

This study demonstrates that the analytics research within this domain, as documented in Scopus, exhibits an inverse logarithmic relationship between the

institutions and the scope of their publication output. Specifically, a small subset of prominent universities—among hundreds—contributes a relatively minor proportion to the overall body of research on 'digital literacy.' Conversely, the research output in this area is predominantly driven by a long tail of less prominent institutions, such as Universidad de Salamanca, Universidad de Málaga, and Universitat d'Alacant, primarily publishing in reputable journals. Notably, our analysis indicates that the primary (core) publications within the Scopus database are notably diverse, with limited representation of conference proceedings.

This finding aligns with the widely held view that peer-reviewed journals are of paramount importance. Interestingly, this observation contrasts with prior studies, which suggested that conference proceedings have a more substantial presence in the literature (Stopar & Bartol, 2019). Another notable result showed that the country with the most documents discussing digital competence is Spain. It is demonstrated that the terms digital literacy, digital competence, digital skills, digital ability, and other similar terms have been developed in Europe since the European Commission created a framework for measuring individuals' digital competence, namely Digeulit, DigComp, and DigCompEdu (Ferrari et al., 2013; Martin & Grudziecki, 2006; Vuorikari Rina, R., Kluzer, S., & Punie, 2022). Additionally, one of the countries in Asia, Indonesia, is included among the top ten countries researching 'Digital literacy.' This indicates that Indonesia is concerned about the rapid development of technology and is actively researching for further innovation and digital literacy training.

The study also aimed to evaluate teachers' digital competence, focusing on vocational high schools. The initial issue identified in this review was analyzing teachers' digital skills, based on previous research that measured their average and standard levels. Overall, since teachers' digital competence was found to be at an intermediate level, this aligns with findings from studies in higher education (Zhao et al., 2021). After analyzing the factors influencing each article, we found that the most significant factor affecting VHS teachers' digital competence was, on average, their age. however, some studies suggest that age is not a major factor impacting teachers' digital literacy (Tomczyk, 2019a).

The study on digital competence improvement showed that previous research recommended training programs to enhance vocational teachers' digital skills. However, another earlier study found that digital competence training could actually reduce teachers' digital skills. Following the training, the teachers did not aim to improve their digital competence or confidence in incorporating technology into the teaching and learning process (Pongsakdi et al., 2021). Nearly 80% of previous studies identified training programs as the most effective way to enhance vocational teachers' digital skills in continuing education. However, some research has adopted alternative methods to boost digital competence. These include integrating digital elements into the curriculum, using educational videos to improve skills, providing tutorials to support understanding, encouraging teachers to practice independently through self-regulated learning without prior training, or implementing standardized assessments focused on digital competence (Anthonysamy et al., 2020a; Gordillo et al., 2021; Hossein-Mohand et al., 2021; Leary et al., 2016).

The authors of the studied papers show that although many improvements have been made to digital competence, including training programs, a more flexible and adaptable approach is needed to better understand the needs, weaknesses, and personal growth of vocational teachers. Digital competence is essential across various sectors and is increasingly recognized as a key skill for future, knowledge-based teaching and learning, aiding the digital transformation of education. The COVID-19 pandemic has highlighted the importance of digital skills in educational settings. Therefore, training should be conducted before any emergency remote learning situations arise due to unforeseen events (König et al., 2020).

Furthermore, we need to understand vocational teachers' digital competence to support their professional development. As a result, the quality of education is more than teaching and learning, which occurs online. The research established a link between emerging new technologies and teacher's barriers to technology integration, which warrants further examination. Analyzed research revealed that the emphasis was on developing digital competence rather than evaluating it in numerous instances, but frequently includes the level of digital

competence. This recent literature review could raise some biases about the study's validity. Moreover, the reviewed articles were not only talking about digital competence in general, but some studies divided the competence measurements into its digital competence branches such as ICT literacy, digital safety literacy, internet literacy, and information literacy. Along with it, this study has generally given a summary of vocational teachers' digital competence, especially in vocational high school, which hopefully has an impact on further studies.

The low digital skills among teachers stem from various factors, such as limited internet and hardware access, time constraints, inadequate government training, absence of online support communities, low self-confidence, adherence to traditional teaching methods, age-related differences, and teachers' attitudes toward technology. Previous studies also highlight that age, prior ICT training, and teaching experience play significant roles in influencing digital competence (Cabezas-González et al., 2021; Saripudin et al., 2021a). This study investigates the underlying reasons for the low levels of digital competence among Indonesian vocational educators. It systematically examines both external and internal determinants that influence digital skill acquisition.

5.2 The challenges of digital competence in vocational education

The thematic analysis from vocational teachers' through FGD identifies three main contributing factors: the rise of technology-centered paradigms, the growth of online social communities, and the mentoring role of younger educators helping senior faculty. The results show that vocational teachers' digital literacy in Indonesia is heavily influenced by complex internal and external factors that can either promote or hinder their development of digital skills. Although government training programs are available externally, many teachers view them as mainly administrative and formal, often lacking practical relevance unless paired with meaningful collaborative experiences. Moreover, the ongoing issue of limited access to key resources like computers and reliable internet forces many educators to depend on personal devices to deliver digital instruction (Amalia, 2015; Billon et al., 2021).

Internally, factors like self-confidence, motivation, and peer interaction serve as stronger predictors of digital competence levels compared to formal training by itself (Bereczki & Kárpáti, 2021; List, 2019). Teachers who proactively pursue professional development opportunities, particularly through engagement with online communities and collaboration with younger, technologically proficient colleagues, tend to demonstrate greater adaptability and more effective utilization of digital technologies. These informal learning networks function not only as platforms for knowledge exchange but also as vital spaces for mutual support and collective problem-solving. Conversely, educators who abstain from engaging with such networks are more susceptible to feelings of isolation and are more likely to rely on outdated instructional practices, thereby exacerbating the disparity between technological capabilities and actual pedagogical competence.

Consequently, these findings suggest that digital competence extends beyond mere access or policy considerations; it embodies an active, adaptive professional behavior wherein the initiative to seek assistance, engage in social learning, and experiment with technological tools significantly influences successful implementation. Accordingly, fostering a culture of community-based learning and cross-generational collaboration may prove to be more efficacious than reliance on traditional, formal training programs alone. This conclusion aligns with prior research indicating that younger educators generally exhibit higher levels of motivation compared to their older counterparts (Calvani et al., 2012; Jiménez-Hernández et al., 2020b; Neagu et al., 2021) .

The emergence of social online communities is identified as the second key insight. According to recent research, this insight highlights that educators actively enhance their digital competencies through engagement, discussion, and knowledge sharing within social online communities. This collaborative environment facilitates interactions between novice and experienced teachers on critical subject matter. However, the study also indicates that Indonesian vocational teachers encounter challenges in utilizing social media groups—particularly the Teachers' Subject Discussion Forum (MGMP)—to support substantive professional development. Teachers reported a discrepancy between the intended objectives of

these groups and the actual content of discussions held within them. To address these issues, fostering mentorship and peer learning initiatives within these online communities may prove effective in empowering teachers to adopt innovative pedagogical practices and to leverage technology more proficiently (Muñoz-Hernández et al., 2021).

This social online community is vital for teachers, enabling them to share their expertise and knowledge with educators from other schools, towns, provinces, and across the nation (Syukri & Riski, 2022). This study, in conjunction with previous research, indicates that school communities play a significant role in enhancing digital literacy among students and teachers through collaborative connection and information sharing. Additionally, the findings suggest that limited access to digital tools and economic constraints pose significant barriers to teachers' efforts to develop their digital literacy (Statti & Torres, 2020). Contrary to the findings of the current study, educators addressed the financial barriers to improving digital literacy by leveraging freely accessible online learning resources available on various digital platforms. Additionally, they mitigated issues related to limited access by utilizing personal laptops or computers.

The young teachers support senior teachers' impact on social online communities. It is closely related to their motivation and ability to use opportunities such as internet access, hardware, training, and time management. Although some schools can access hardware and the internet, not all teachers can use it for professional development through online courses, discussions, or self-learning. A study from Kenya found that even after the government provided ICT infrastructure, teachers' digital literacy readiness still needed improvement and training (Okello et al., 2020).

This study also found that teachers' digital skills depend not only on access but also on their engagement with technology and motivation to implement their knowledge into the teaching process. There is a need for collaborative efforts among vocational teachers, educational institutions, and relevant stakeholders to address these challenges. Facilitating targeted professional development

opportunities accessible to all teachers is essential for fostering a culture of lifelong learning and continuous improvement. Promoting mentorship and peer learning initiatives can harness the collective expertise within the teaching community to support one another in adopting innovative teaching practices and leveraging technology effectively (Muñoz & Ruiz-Domínguez, 2021).

Like other professionals, teachers have had greater access to digital tools, information, and resources in the past few decades (Prestridge & Tondeur, 2015). However, various personal and contextual factors drive the complex subject of the emergence of digital competence for instructors in vocational high schools. Digital competence is essential for successfully integrating technology into education, and this is especially important in vocational education and training (VET) contexts. According to research, VET teachers in Switzerland have a comparable level of digital competence to their counterparts in other educational domains, with personal factors such as attitude toward technology and frequency of digital tool use playing an essential role in their competence development (Cattaneo et al., 2022a). In this third contribution, teachers with a long teaching journey have more skill in pedagogy than young teachers who are fast learners of digital media and its development.

This study found that senior teachers struggle to follow digital media development. Therefore, teachers in the FGD defined support and sharing between senior and young teachers as a powerful alternative to training or joining a course. It is comparable with the previous study, which found that age is one of the most significant factors influencing individuals' digital competence and the majority of the young generation is more skillful than the elder generation (Damşa et al., 2021; Diao & Hu, 2022; Jiménez-Hernández et al., 2020b; Tohara et al., 2021). Moreover, the key factor influencing teachers' belief and motivation is their acceptance towards technology, which aligns with the technology acceptance model as studied by Antonietti (Antonietti et al., 2022b).

Finally, the discussion also defined that the emergence of technology-related ideas could improve vocational teachers' low digital competence. To develop teachers' digital competence, teachers use online platforms to learn about digital media, especially YouTube. According to the educators surveyed, YouTube is perceived as a more accessible resource compared to educational premium courses, which often entail a high cost, and they have limited funding for joining certified courses. This strategy is aligned with the previous research on teachers' strategies for improving their digital competence through self-directed learning (Anthonysamy et al., 2020b). The study examined the guidance of self-regulated learning strategies (SLRS) for individuals, which is believed to be an effective way of improving digital competence. For the self-directed learning method, teachers typically experiment with their knowledge from YouTube before incorporating it into the teaching process, and they state that learning online is effective.

The teachers exhibit low digital competence due to a lack of internal and external support. A crucial form of support comes from the collaboration between younger and older teachers, which can help bolster their confidence in utilizing technology through their digital skills. By fostering a supportive community, they can embrace technology more fully and integrate it into their teaching and learning practices, guided by the three concepts of the Technology Acceptance Model (TAM): perceived usefulness, perceived ease of use, and attitude.

5.3 The priority of digital competence for vocational educators

The findings derived from the questionnaire suggest that the most extensively mastered competencies pertain to ethical considerations in the application of digital technologies. Additionally, collaboration skills emerged as the highest priority from the educators' perspectives, corroborating existing research that underscores the significance of communication and teamwork skills within industry contexts (Irwansyah & Hardiah, 2020). Collaboration enhances self-efficacy and promotes effective interpersonal interactions. This assertion is further supported by empirical research indicating that such skills are critically important in industrial settings (Hatlevik, 2016). However, it is quite unfortunate that many graduates in vocational

education still demonstrate low communication skills (Amrutha & Geetha, 2019), thus, industry experts highlight the importance of transferable skills in technical communication and promote collaboration between industry and training institutions to address this need.

A Fuzzy Analytical Hierarchy Process (F-AHP)-based decision-making model was used to determine the weight and priority of each dimension (Coffey & Claudio, 2021). The F-AHP results showed that the "empowering learners' digital competence" and "communication and collaboration" components ranked highest, followed by digital teaching and learning, as well as digital safety. All models met the requirements for ratio consistency and high stability in the sensitivity test. Sensitivity analysis was employed to see the stability dimensions with several changes. Triangulation results between surveys, FGDs, and the expert panel were considered to ensure the reliability, relevance, and acceptability of the model. The results of this chapter serve as the basis for developing strategies for sustainable digital competency development, both through training and curriculum updates and cross-sector collaboration between vocational schools and industry.

This divergence in viewpoints introduces considerable challenges, particularly within the context of decision-making processes. To effectively address these complexities, scholars have synthesized three foundational perspectives, drawing upon expertise from diverse disciplines, namely Education, Technical and Vocational Education and Training (TVET), and Information Technology (IT). The Fuzzy Analytic Hierarchy Process (F-AHP) analysis integrates multiple response criteria, derived from a variety of components, thereby establishing a comprehensive framework to support informed decision-making. The highest weighting criterion was attributed to the IT expert perspective, with a score of 0.21, followed by experts in education (0.20) and TVET (Technical and Vocational Education and Training) experts (0.16). This distribution aligns with the recognized significance of incorporating industry perspectives in the formulation of vocational education curricula, thereby addressing the persistent skills gap between

educational programs and current industry requirements (Somantri & Pramudita, 2024).

This identification process yielded a prioritized order of digital competencies crucial for integration, particularly within the context of vocational education. The findings not only underscored the necessity for digital literacy among vocational educators, aligning with global trends and advancements, but also highlighted the alignment of educational needs with industry requirements. Additionally, this process facilitated the development of a model intended to serve as a reference framework for the enhancement of vocational education, with a particular focus on its integration into the curriculum.

The development of the integrated digital competence framework in this study reflects a methodological lineage shared with prior research on educational and vocational competence frameworks, where an iterative, multi-stage cycle is central to ensuring contextual relevance and empirical robustness. Similar to established approaches (e.g., Ferrari et al., 2013; Vuorikari et al., 2022; Cattaneo et al., 2022a), this study adopted a design process beginning with extensive stakeholder engagement through FGDs with vocational educators, followed by a nationwide survey, and culminating in iterative validation with an international panel of experts. This multi-phase approach mirrors earlier works that also combined bottom-up practitioner input with top-down expert review, recognizing that frameworks must be grounded in classroom realities while meeting internationally recognized benchmarks. The involvement of experts from three continents—Asia, Australia, and Europe—ensured that the framework did not merely reflect national conditions but incorporated diverse cultural, pedagogical, and industrial perspectives. This geographical spread of expertise parallels the global collaborative processes seen in the development of the DigCompEdu framework and its adaptations, where the aim is to harmonize local needs with global digital competence standards.

The cyclical refinement process employed in this study resonates with the model proposed by McKenney and Reeves (2012) for design-based research, in

which analysis, design, and evaluation phases are revisited to progressively improve the intervention—in this case, the framework. In the present study, educator FGDs informed the identification of key components and contextual needs; the survey phase quantified competence levels and priorities; and expert pairwise comparisons using Fuzzy AHP, validated through SAW and TOPSIS, established a defensible prioritization of competencies. Previous studies using similar multi-criteria decision-making methods for framework development confirm the value of this structured expert judgment process, particularly in contexts where stakeholder perspectives may diverge (Laarhoven & Perdrycz, 1983; Saaty, 2008). By integrating the views of IT specialists, TVET experts, and education professionals, the resulting model addresses the often-cited gap between pedagogical theory and industrial application (Somantri & Pramudita, 2024).

What distinguishes the current framework from many prior digital competence models is its explicit integration of vocational educators' needs alongside embedded ethics considerations across all components. While previous models such as DigCompEdu and UNESCO's ICT Competency Framework for Teachers acknowledge ethical use as a discrete domain, the present study—guided by FGD and survey findings—treats ethics as a transversal element influencing every competency, from information literacy to problem-solving. This is consistent with recent scholarship highlighting that ethical awareness, particularly in an era of AI-assisted teaching, cannot be siloed but must permeate all aspects of digital competence (Cabero-Almenara, Gutiérrez-Castillo, et al., 2020; Cabero-Almenara, Romero-Tena, et al., 2020). Moreover, the vocational education focus requires that each component supports the integration of industry-relevant content, aligns with technological developments in the workplace, and maintains fidelity to pedagogical standards. This tripartite emphasis—pedagogy, industry, and ethics—offers a novel contribution to the literature, positioning the framework not only as a tool for teacher professional development but also as a bridge between vocational schools and the evolving demands of the global labor market.