

Digital Skills in Malaysian Entry-Level Job Advertisements: Implications for Graduate Employability

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ABSTRACT

This study investigates the mention for digital skills in Malaysian entry-level job advertisements to understand the digital competencies expected from fresh graduates in the era of Industry 4.0. The study analysed 8,287 entry-level job postings extracted from the 2024 JobStreet Malaysia dataset sourced from Kaggle. Python-based text processing and rule-based keyword matching techniques were employed to identify and classify digital skills into nine thematic categories, including productivity tools, data analytics, programming, cloud/infrastructure, cybersecurity, automation/AI, digital marketing, finance/ERP/CRM, as well as specialised tools. The findings reveal that Microsoft Excel and Microsoft Office remain the most frequently mentioned digital skills. At the same time, specialised competencies such as Git, SQL, SAP, AWS, AutoCAD, and programming languages were also identified in the advertisements. The study also found that multiple digital skills were frequently mentioned together within individual advertisements. Variations in digital skill themes were also observed across job roles, particularly among administrative, finance, and engineering-related positions. These findings suggest that foundational digital literacy is still important in the contemporary workplace. However, there are growing expectations for job-specific digital expertise. The findings indicate that entry-level job advertisements may specify both foundational and specialised digital competencies. The findings provide evidence of digital-skill patterns communicated through entry-level job advertisements and highlight the need for higher education institutions to strengthen the alignment of curricula with labour market demands by embedding digital skills in curricula and offering relevant training to improve graduate employability.

Keywords: Digital Skills; Graduate Employability; Entry-Level Employment; Job Advertisements; Higher Education; Malaysia

INTRODUCTION

Organisational systems across industries are rapidly transforming as a result of Industry 4.0 (French et al., 2021). This transformation is driven by the evolution of digital technologies and the growing adoption of artificial intelligence (AI), the Internet of Things (IoT), and data analytics (Huber et al., 2022; Bag & Wood, 2022). These technologies are not only changing the way organisations operate but have redefined the types of competencies required from the employees (Nadkarni & Prügl, 2021). This shift has encouraged workers to upskill and acquire new digital competencies aligned with the technologies (Pacheco & Coello-Montecel, 2023). Digital skills have become central not only to workforce readiness but also to graduate

employability (Mahmud & Wong, 2022; Kee et al., 2023). As a result of these technology-driven changes, employers increasingly expect graduates to possess practical digital competencies in addition to academic qualifications. This requirement is particularly important for entry-level positions, where fresh graduates are expected to adapt quickly to technology-enabled work environments. However, past studies revealed a persistent mismatch between the digital skills taught at universities and those required by employers (Tee et al., 2024a; Jensen & Schneider, 2026).

In the context of Malaysia, the urgency of digital workforce development has been reinforced through national initiatives such as MyDIGITAL and the Malaysia Digital Economy Blueprint, which emphasise the need to prepare a digitally competent workforce (Ministry of Communications and Digital, 2021). However, despite these policy efforts, concerns remain regarding whether graduates possess the specific digital skills required by employers. According to Tee et al. (2024b), Malaysian employers increasingly prioritise digital skills for entry-level graduates. Digital skills are linked with job performance, workplace productivity, digital communication, data literacy, and problem-solving (Feijao et al., 2021; Xie & Yang, 2025). Employers not only expect employees to use digital skills for routine tasks but also value graduates who can leverage digital tools to drive innovation, enhance organisational agility, and support effective decision-making. However, Malaysian graduates often face challenges in meeting workplace expectations, particularly when theoretical knowledge is not supported by hands-on proficiency in digital tools and platforms (Rahmat et al., 2022). According to Senadjki et al. (2025), employers continue to report difficulties recruiting graduates with adequate competencies in areas such as data analytics, cloud computing, automation, and workplace productivity tools. Consistent with this concern, Tay et al. (2021) found that Malaysian manufacturing firms face major challenges in data management, technology adoption, education, and workforce readiness when implementing Industry 4.0. Employers have also reported digital skills gaps among employees, which may hinder productivity and economic growth (Nair, 2021). This highlights that digital competencies have become an important component of 21st-century competencies and are essential for graduate employability. Consequently, graduates who can proficiently use digital tools and technologies significantly improve their employability (Wee, 2023).

Although these studies provide useful insights into organisational challenges, they do not clearly identify the exact digital skills required by employers for fresh graduates or entry-level positions. The study by Tee et al. (2024a) provides important evidence on digital skills demanded by Malaysian employers through a survey-based approach. Other studies have examined digital skills, employer expectations, workforce readiness, and graduate employability through surveys, interviews, or other perception-based methods (Arnold, 2023; Saari et al., 2021; Doraisamy, 2022). However, research using actual labour market data remains limited as the findings from current studies may not fully reflect real-time recruitment demand. Unlike previous perception-based studies, this study examines digital-skill patterns communicated through actual job advertisements by adopting a data-driven content analysis approach using 2024 JobStreet Malaysia data. This approach enables the study to identify digital competencies explicitly mentioned in entry-level recruitment advertisements. The main objective of this study is to (1) identify the most frequently mentioned digital skills in Malaysian entry-level job postings; (2) examine common digital skill combinations; and (3) compare digital skill themes across major entry-level occupations. By focusing on entry-level roles intended for fresh graduates, this study provides timely insights into the digital competencies mentioned by Malaysian employers.

LITERATURE REVIEW

Graduate Employability

Employability is not merely about securing a job; rather, it refers to a set of competencies that increases graduates' likelihood of gaining employment and succeeding in their chosen occupations. Graduate employability encompasses a combination of hard and soft skills, including academic qualifications, technical expertise, adaptability, communication, and problem-solving (Alam et al., 2025; Kamaruzaman et al., 2025). However, in the contemporary workplace, employers require graduates who possess digital literacy and technical competencies as well as the ability to adapt, sustain, and thrive in a rapidly changing

labour market (Pauceanu et al., 2020; Ahmad Tajuddin et al., 2022). Therefore, digital literacy is increasingly recognised as a foundational competency for employability in the 21st century (Vrana, 2016; Apata et al., 2025). The European Digital Competence Framework (DigComp) provides a robust and widely recognised structure for understanding digital literacy. It defines five key areas of digital competence: (a) Information and Data Literacy, the ability to locate, evaluate, and manage digital information; (b) Communication and Collaboration, using digital tools to interact, share, and collaborate effectively; (c) Digital Content Creation, developing and managing digital content, including programming; (d) Safety, ensuring cybersecurity, digital wellbeing, and responsible use of technology; and (e) Problem Solving, addressing technical and conceptual challenges in digital contexts (Jashari et al., 2020; Vuorikari, 2022; Barboutidis & Stiakakis, 2023; Cosgrove & Cachia, 2025). These digital competencies, along with other critical abilities, such as communication, ethical decision-making, and adaptability, are essential for meeting the demands of the modern job market in various industries (Retelj, 2022; Idrizi & Nuredini-Mehmedi, 2025). For example, artificial intelligence, data analytics, and cloud computing are no longer confined to IT roles but are becoming important across positions and backgrounds. Fields such as finance, business, education, and marketing have also relied on data analytics for insights into consumer and employee behaviour and market trends. Although graduates recognise the importance of continuous learning and upskilling to remain competitive in a rapidly evolving job market, they perceive a significant gap between their academic training and the skills required in the workforce (Balve & Manoharan, 2026). Therefore, educational frameworks must prioritise interdisciplinary learning by integrating these digital technologies into a cohesive curriculum and promoting lifelong-learning ecosystems that prepare students for future challenges (Baskara, 2025) and support ongoing professional development (Zhou et al., 2025).

Human Capital Theory and Competence-Based View of Employability

Human Capital Theory (HCT) by Becker (1964) posits that individuals possess a set of skills, knowledge, and capabilities that can be upgraded through education and training. It provides a foundational framework for understanding how investments in skills and education enhance employability. Another perspective that aligns with HCT is the competence-based view of employability. This perspective views employability from a competence-based dimension, whereby competency is defined as knowledge, skills, and abilities. On the other hand, Abelha et al. (2020) categorise competencies into two groups: technical, core, or subject-specific competencies, which relate to disciplinary knowledge, and transversal competencies, which include soft skills such as communication, teamwork, and digital competence. The study also highlights the growing importance of digital skills for graduate employability, which must be addressed by higher education institutions. In the modern workplace, digital competency is viewed as an individual's human capital, which links to employability. Therefore, students who invest time and effort in upgrading their digital capital will enhance their market value and employability (Sozon et al., 2026). Besides that, these competences can be developed and assessed within the context of higher education institutions. Abelha et al. (2020) call for a competency-based approach to employability in higher education curriculum design and development.

This may include implementing work-based learning experiences that require students to undertake projects or case studies in authentic settings, participate in technical visits, or complete internships. These practices are commonly described as pedagogies for employability. This concept encompasses six dimensions: learning and teaching practices, alternative methods of assessment, work-based and work-related learning, staff engagement, pedagogical competencies, and strategy (Pegg et al., 2012). Furthermore, competence-based education models are increasingly used to align higher education curricula with labour market needs. For example, DigComp has been used to assess and develop students' digital skills (Torres-Coronas & Vidal-Blasco, 2015; Maya Ortiz, 2025). The development of competences in higher education is also strongly related to the Sustainable Development Goals (SDGs), SDG4: Quality Education and SDG8: Decent Work and Economic Growth. Higher education institutions need to acknowledge the fact that they play a significant role in the promotion and development of graduates' employability competencies.

METHODOLOGY

This study employed a data-driven content analysis approach to examine digital skills mentioned in entry-

level job advertisements in Malaysia. The analysis used the publicly available *JobStreet Malaysia 2024* dataset obtained from Kaggle. The original dataset comprised 57,589 job advertisements and contained seven fields: job title, job description, location, category, subcategory, role, and listing date. To identify entry-level vacancies, the job title and job description fields were first converted to lowercase to facilitate case-insensitive text processing. Entry-level advertisements were then identified based on the occurrence of either of two predefined terms, “fresh graduate” or “entry level,” in the job description. Advertisements containing at least one of these terms were tagged as entry-level vacancies. This procedure resulted in 8,287 entry-level advertisements from the original 57,589 job advertisements, which formed the analytical sample for the study. A rule-based keyword-matching approach was used to identify digital skills within the job descriptions. A predefined dictionary grouped digital skills into nine themes: Data & Analytics, Programming, Digital Marketing, Cloud/Infrastructure, Cybersecurity, Automation/AI, Productivity Tools, Finance/ERP/CRM, and Specialised Tools. The keywords associated with each theme are presented in Table 1. For example, Data & Analytics included Excel, Power BI, Tableau, and SQL; Programming included Python, HTML, CSS, Java, and Git; while Productivity Tools included Microsoft Office, Google Workspace, and Zoom. Two variables were generated from the job descriptions. First, *digital_themes* represented the primary digital-skill theme identified in an advertisement. The Python-based classification function searched the themes and their associated keywords sequentially and assigned the advertisement to the first theme for which a keyword match was detected. Advertisements without a matching keyword were classified as having no identified digital-skill theme. Second, *matched_skills* captured all predefined digital-skill keywords detected within each job description. Unlike the primary-theme classification, this procedure retained multiple skill matches when more than one predefined digital skill appeared in the same advertisement. Descriptive analyses were conducted using Python. Frequencies were calculated for the individual digital skills identified in the *matched_skills* variable. Skill combinations were determined for advertisements containing more than one matched skill by sorting and combining the detected skills and subsequently counting the frequency of each combination. To examine variation in digital-skill themes across job titles, job titles were converted to lowercase and leading and trailing spaces were removed. The documented analysis also standardised “accounts executive” as “account executive.” Theme frequencies were then calculated by job title, and the five job titles with the highest numbers of digital-skill-theme mentions were selected for comparison. Finally, the proportion of entry-level advertisements containing at least one identified digital skill was calculated from the *matched_skills* variable. Data processing was conducted using Python, and the visualisations were generated using Matplotlib.

Table 1 Thematic Categorisation of Digital Skills

Theme	Example Skills
Data & Analytics	Excel, Power BI, Tableau, SQL
Programming	Python, HTML/CSS, Java, Git
Digital Marketing	SEO, Google Ads, Canva, Meta Ads
Cloud/Infrastructure	AWS, Azure, Google Cloud
Cybersecurity	Risk management, PDPA, basic cybersecurity
Automation/AI	RPA, ChatGPT, TensorFlow
Productivity Tools	Microsoft Office, Google Workspace, Zoom
Finance/ERP/CRM	SAP, SQL Accounting, Salesforce
Specialised Tools	AutoCAD, SPSS, POS Systems

RESULTS AND DISCUSSION

Overall, 60.28% of the 8,287 entry-level job advertisements analysed contained at least one of the predefined digital-skill keywords. This indicates that explicit references to digital skills were common within the analysed entry-level advertisements.

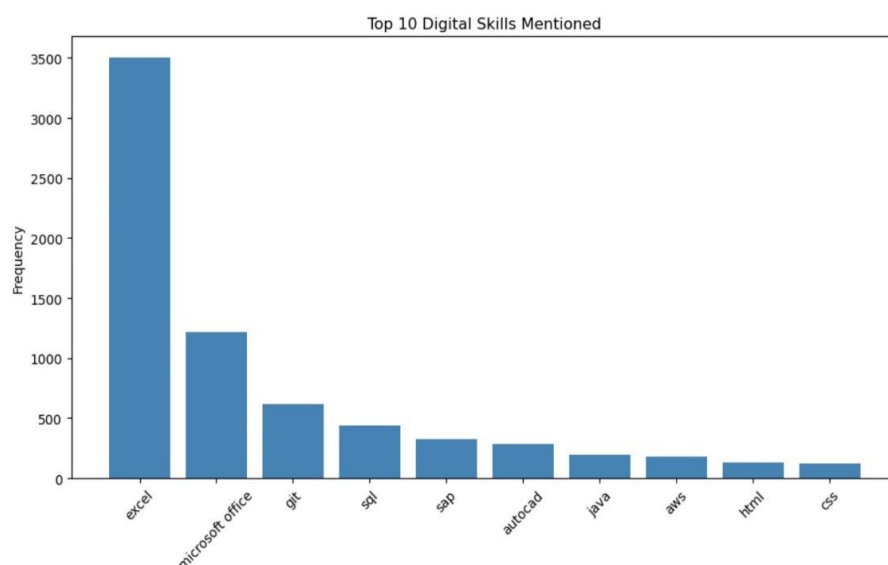
Most Frequently Mentioned Digital Skills

Figure 1 presents the ten most frequently mentioned digital skills across 8,287 entry-level job postings in Malaysia. Microsoft Excel was the most frequently mentioned digital skill, appearing in 3,503 job advertisements. This was followed by Microsoft Office (1,220), Git (621), SQL (442), SAP (322), AutoCAD (284), Java (199), AWS (182), HTML (135), and CSS (120). The high frequency of Excel mentions indicates its prominence among the digital skills explicitly specified in the analysed entry-level job advertisements. Microsoft Excel is a spreadsheet application that allows users to organise information by sorting and filtering data, perform calculations, generate charts, and produce meaningful reports to support decision-making. According to Nicholas et al. (2025), competence in Excel is crucial for business students to gain a competitive advantage in the job market. Excel can be used by business graduates for various tasks, including data organisation, cash flow management, financial statement analysis, and marketing budget management.

Similarly, this skill is essential for accounting students, as it enables them to perform cost-benefit analyses, maintain financial records, and solve complex business problems (Doe et al., 2016). Excel is also considered a fundamental skill in administrative occupations, where it is widely used to manage organisational data and generate automated, dynamic reports (Khalila et al., 2025). However, in higher education, students are often exposed to Excel only at a basic level (Khalila et al., 2025). Consequently, several authors have advocated integrating Excel more extensively into teaching and learning practices. For example, Excel can be incorporated into course-based projects and case studies (Ghasemi et al., 2021), scenario-based learning activities (Ibrahim & Nat, 2022), and internship programmes that provide authentic workplace experience (Widiastuti & Mahadwartha, 2022). These studies found that the use of Excel enhances students' logical reasoning, analytical skills, critical thinking, confidence, and work efficiency.

Furthermore, students' ability to use Excel beyond basic functions has been positively associated with internship performance and self-efficacy (Lin & Yu, 2023). Similarly, Pranoto and Sulisty (2024) reported that business graduates who were exposed to advanced Excel modules during their university studies adapted quickly to digital workflows in the workplace. Overall, the prominence of Excel in the analysed advertisements, together with previous studies highlighting its workplace applications, suggests that spreadsheet proficiency remains relevant to the preparation of graduates for entry-level employment. Higher education institutions may therefore consider strengthening the integration of spreadsheet applications into relevant curricula, including finance, marketing, and human resource management courses, where students can apply these skills in discipline-specific contexts.

Figure 1 Top 10 Digital Skills



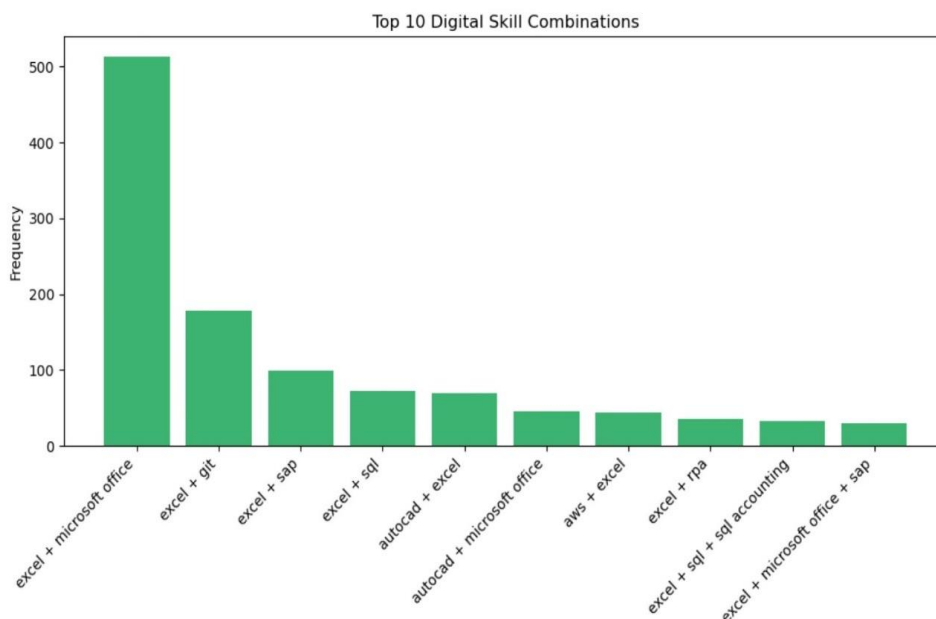
Common Digital Skill Combinations

Figure 2 presents the ten most frequently mentioned combinations of digital skills in entry-level job advertisements. Microsoft Office + Excel was the most frequent two-skill combination, appearing in 514 job postings. Although Excel is a core application in the Microsoft Office suite, it was coded under the Data and Analytics theme because employers frequently listed Excel as a distinct competency in their job advertisements. In contrast, Microsoft Office was classified under the Productivity Tools theme to represent general office productivity applications, including Word, PowerPoint, Outlook, Publisher and Access. The frequent co-occurrence of Microsoft Office and Excel indicates that some advertisements explicitly mention Excel in addition to broader Microsoft Office proficiency. Within the present classification framework, Microsoft Office represents general productivity applications, whereas Excel is classified under Data & Analytics.

While proficiency in Microsoft Office reflects a general ability to perform routine office tasks, the separate specification of Excel alongside Microsoft Office further illustrates the visibility of spreadsheet-related competencies within the analysed advertisements. This interpretation is consistent with the findings presented in Section 4.1, where Excel emerged as the most frequently mentioned digital skill across entry-level positions. Previous studies have similarly highlighted Excel as a critical workplace competency (Nicholas et al., 2025; Doe et al., 2016; Khalila et al., 2025).

The co-occurrence of Excel with specialised skills such as SQL, SAP, Python, and Git indicates that general spreadsheet proficiency and more specialised technical competencies are sometimes specified together within entry-level job advertisements. These findings align with Petrová (2022), who argued that employers increasingly value graduates who possess a combination of technical competencies and business-related skills. Similarly, Rahmat et al. (2022) highlight the need for graduates to acquire multiple skill sets, including technical and non-technical digital skills, to enhance their employability. Such findings are also consistent with the DigComp framework, which conceptualised digital competence as a combination of multiple competency areas, including information and data literacy, digital content creation, communication and collaboration, problem solving, and safety (Jashari et al., 2020; Vuorikari, 2022; Barboutidis & Stiakakis, 2023; Cosgrove & Cachia, 2025). In sum, the findings suggest that higher education institutions should expose students to industry-specific software relevant to their respective disciplines, thereby improving their workplace readiness.

Figure 2 Top 10 Digital Skills Combinations



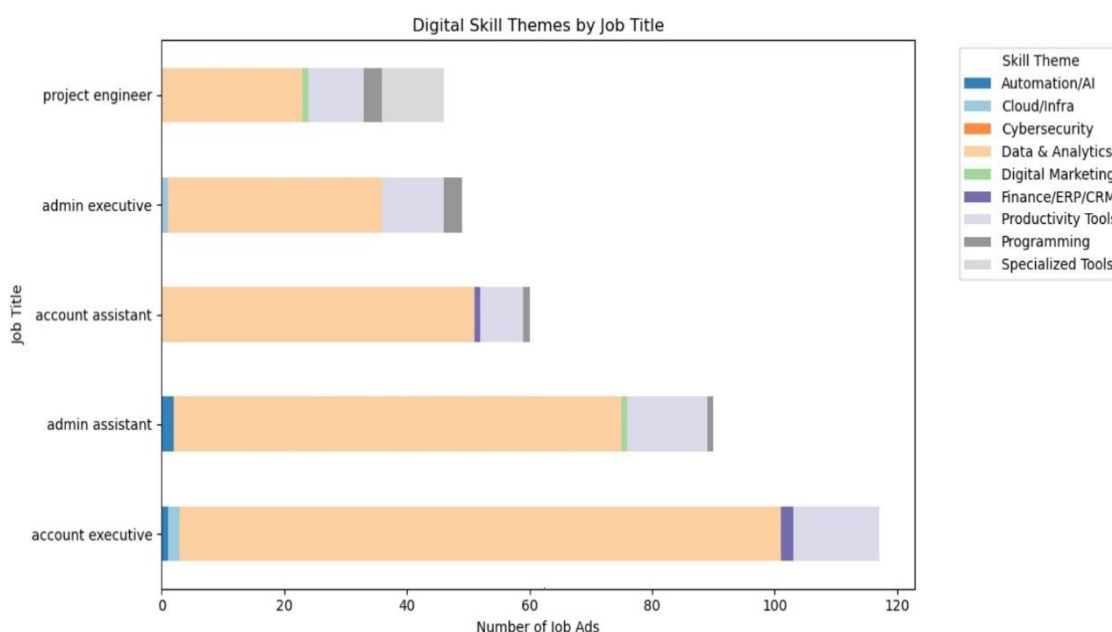
Variation in Digital Skill Themes Across Job Titles

Figure 3 presents the distribution of the primary digital-skill themes assigned to the five entry-level job titles with the highest numbers of classified digital-skill advertisements. As each advertisement was assigned to one primary theme based on the first matching keyword in the predefined classification sequence, the figure represents primary thematic classification rather than all possible digital-skill themes contained within an advertisement. Overall, Data & Analytics accounted for the largest share of primary theme classifications across the five selected job titles. This pattern is consistent with the high frequency of Excel identified in Sections 4.1 and 4.2 and indicates that Data & Analytics-related skills were prominent across the five job titles examined. Account Executive and Account Assistant advertisements showed a relatively greater representation of Finance/ERP/CRM as the primary digital-skill theme, whereas Specialised Tools were more prominent among Project Engineer advertisements.

These findings highlight the importance of job-specific software alongside general digital skills. The presence of Data & Analytics across the five job titles examined also demonstrates that digital-skill requirements are not confined to technology-oriented positions. Nevertheless, the findings should be interpreted as patterns of skill mentions within advertisements rather than direct evidence of the relative importance of these skills to employment outcomes. Previous research has highlighted the broader workplace applications of data analytics across business, marketing, healthcare, education, finance, manufacturing, and other sectors (Turner, 2026). Viewed alongside this literature, the present findings suggest that exposure to data-related digital tools may be relevant across multiple disciplinary contexts.

From a higher education perspective, the findings suggest that universities should strengthen the integration of digital competencies across the curriculum by adopting a two-tier approach to digital competency development. At the first tier, students should be equipped with foundational digital skills such as Microsoft Excel and Microsoft Office, which were frequently mentioned across the analysed advertisements. At the second tier, students should be exposed to discipline-specific digital skills that reflect the digital tools associated with particular occupational contexts. For example, accounting students could be introduced to SAP and SQL Accounting, and engineering students to AutoCAD. Previous research has similarly highlighted the importance of integrating advanced AutoCAD training into engineering curricula and fostering partnerships with engineering firms to enhance practical exposure (Effiong, 2025). Such an approach may help align students' digital competency development with the general and occupation-specific patterns observed in entry-level job advertisements.

Figure 3 Comparison of Digital Skill Themes Across Five Most Common Entry-Level Job Titles



CONCLUSION

The findings of this study can be interpreted through Human Capital Theory, which conceptualises knowledge and skills developed through education and training as forms of human capital. In the context of this study, the prominence of digital-skill mentions in entry-level job advertisements indicates that digital competencies form part of the skill profiles communicated by employers when recruiting for early-career positions. However, the findings also suggest that digital human capital is not homogeneous. While general tools such as Excel and Microsoft Office were frequently mentioned, more specialised competencies such as SAP, AutoCAD, SQL, Git, and AWS appeared alongside or within particular occupational contexts. This distinction provides a more nuanced application of Human Capital Theory to contemporary graduate employability. Rather than treating digital competence as a single form of human capital, the findings point to a distinction between broadly applicable and more occupation-specific digital competencies. This interpretation is reflected in the proposed two-tier approach to digital competency development: foundational digital competencies that may have relevance across multiple entry-level occupations, followed by specialised competencies aligned with particular disciplinary or occupational contexts. Importantly, the present study does not establish that possessing these competencies causes improved employment outcomes; rather, it identifies the forms of digital human capital visible in entry-level recruitment advertisements.

The findings also have practical implications for higher education institutions. The frequent presence of digital skills in the analysed entry-level job advertisements highlights the relevance of digital competency development in preparing students for contemporary labour-market expectations. In particular, the frequent mentions of Microsoft Excel and Microsoft Office indicate the continued prominence of foundational productivity and data-related tools in entry-level job advertisements. Higher education institutions may therefore consider providing students with opportunities to develop practical proficiency in the application of these tools within their respective disciplinary contexts. Based on these patterns, a two-tier approach to digital competency development may be considered, combining broadly applicable foundational competencies with specialised competencies aligned with particular occupational contexts. This approach could be supported through experiential and work-integrated learning activities, including industry projects, internships, simulations, and industry partnerships that provide students with opportunities to apply digital tools in authentic contexts. Nevertheless, the findings should be interpreted within the scope of the study. The analysis captures the explicit presence and frequency of predefined digital-skill keywords in Malaysian entry-level job advertisements and should not be interpreted as a direct measure of the relative importance of particular skills or their causal effects on graduate employability. Furthermore, the keyword-based identification of entry-level advertisements using the terms “*fresh graduate*” and “*entry level*” may have excluded graduate-suitable vacancies that did not explicitly use these terms and may have included advertisements that used these terms but imposed additional requirements. The thematic analysis was also based on predefined keyword categories, with each advertisement assigned to a single primary digital-skill theme based on the first matching category. Consequently, the findings should be understood as indicative patterns within the analysed advertisements rather than an exhaustive representation of digital competencies required across the Malaysian graduate labour market. Despite these limitations, the study provides data-driven insights that may assist higher education institutions, policymakers, and curriculum developers in considering how digital competency development can respond to patterns observed in entry-level recruitment advertisements.

Suggestions

This study provides evidence of the digital skills currently mentioned in Malaysian entry-level job advertisements. Future research could extend these findings by examining how digital competencies influence graduate employability outcomes, investigating mismatches between the digital competencies developed by universities and those required by industry, and evaluating the effectiveness of digital curricula in enhancing students' workplace readiness and digital self-efficacy.

Co-Author Contribution

Author 1 conceived the study, supervised the data processing and analysis, interpreted the findings, drafted and revised the manuscript. Author 2 reviewed and refined the methodology and findings. Authors 3, 4 and 5 contributed to the literature review, introduction, and discussion sections, respectively. All authors reviewed and approved the final manuscript.

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Declaration of AI-Generated Content

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REFERENCES

1. Abelha, M., Fernandes, S., Mesquita, D., Seabra, F., & Ferreira-Oliveira, A. T. (2020). Graduate employability and competence development in higher education—A systematic literature review using PRISMA. *Sustainability*, 12(15), 5900.
2. Ahmad Tajuddin, S. N. A., Bahari, K. A., Al Majdhouh, F. M., Balraj Baboo, S., & Samson, H. (2022). The expectations of employability skills in the Fourth Industrial Revolution of the communication and media industry in Malaysia. *Education+ Training*, 64(5), 662-680.
3. Alam, M. J., Noman, S., Mujib, M. N. I., & Khan, W. S. (2025). An assessment of graduates skills gap for sustainable employability during the 4IR in Bangladesh. *Social Sciences & Humanities Open*, 12, 101780.
4. Apata, S. B., & Oyenuga, M. O. (2025). Revolutionizing Employability: The Intersection of Digital Literacy, Inclusive Education, and Gen Z's Skill Set in the 21st Century. In *Empowering pre-service teachers to enhance inclusive education through technology* (pp. 155-182). IGI Global Scientific Publishing.
5. Arnold, S. (2023). Skills narratives amongst media degree graduates and students: Discourses of hard and soft skills in education-to-work journeys. *Industry and Higher Education*, 37(4), 485–495.
6. Bag, S., and Wood, L. C. (2022). Guest editorial: Human resource development in the digital age: Recent issues and future research directions. *International Journal of Manpower*, 43(2), 253–262.
7. Balve, A., & Manoharan, G. (2026). Fostering the Role of Higher Education in Employability Through AI Adoption. In *Enhancing Graduate Employability in an Evolving Workforce* (pp. 373-396). IGI Global Scientific Publishing.
8. Barboutidis, G., & Stiakakis, E. (2023). Identifying the factors to enhance digital competence of students at vocational training institutes. *Technology, knowledge and learning*, 28(2), 613-650.
9. Baskara, F. R. (2025). Conceptualizing digital literacy for the AI era: A framework for preparing students in an AI-driven world. *Data and Metadata*, 4(530), 1-13.
10. Becker, G. S. (1964). Human capital: A theoretical and empirical analysis, with special reference to education. National Bureau of Economic Research.
11. Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European digital competence framework. Publications Office of the European Union.
12. Doe, M., Annan, E. M., Ahiale, F. K. A., & Robert, A. (2016). Lack of competence in using Microsoft Excel by accounting students. *Global Journal of Commerce & Management Perspective*, 5(4), 39-42.
13. Doraisamy, P. (2022). Determinants of digital skills in current technology advanced workforce in Malaysia [Master's thesis, Universiti Utara Malaysia].
14. Effiong, E. E. (2025). Assessment of AutoCAD proficiency among civil engineering students in Cross River State, Nigeria: Implications for advancing contemporary civil engineering practices. *International Journal of Functional Research in Science and Engineering (IJFRSE)*, 3(2), 48-55.

15. Feijao, C., Flanagan, I., van Stolk, C., and Gunashekar, S. (2021). The global digital skills gap: Current trends and future directions. RAND Corporation. https://www.rand.org/pubs/research_reports/RRA1533-1.html
16. French, A., Shim, J. P., Risius, M., Larsen, K. R., and Jain, H. (2021). The 4th industrial revolution powered by the integration of AI, blockchain, and 5G. *Communications of the Association for Information Systems*, 49(1), Article 6.
17. Ghasemi, M., Shafeiepour, V., Aslani, M., & Barvayeh, E. (2021). The impact of using Microsoft Excel in teaching mathematics. *Procedia - Social and Behavioral Sciences*, 28(2), 426–430. <https://doi.org/10.1016/j.sbspro.2021.10.111>
18. Ghasemi-Gol, M., Pujara, J., & Szekely, P. (2021). Learning cell embeddings for understanding table layouts. *Knowledge and Information Systems*, 63(1), 39-64.
19. Huber, R., Oberländer, A. M., Faisst, U., and Röglinger, M. (2022). Disentangling capabilities for Industry 4.0: An information systems capability perspective. *Information Systems Frontiers*, 1–29.
20. Ibrahim, M., & Nat, M. (2022). Enhancing digital skills through Excel-based learning: An applied approach in Indonesian higher education. *Journal of Education and Learning*, 11(3), 210–218. <https://doi.org/10.5539/jel.v11n3p210>
21. Idrizi, E., & Nuredini-Mehmedi, L. (2025, June). Integrating the DigComp Framework: A University-Wide Initiative to Develop First-Year Digital Competencies. In *2025 MIPRO 48th ICT and Electronics Convention* (pp. 351-356). IEEE.
22. Jashari, X., Fetaji, B., Nussbaumer, A., & Gütl, C. (2020, February). Assessing digital skills and competencies for different groups and devising a conceptual model to support teaching and training. In *International Conference on Remote Engineering and Virtual Instrumentation* (pp. 982-995). Cham: Springer International Publishing.
23. Jensen, M. F., & Schneider, C. (2026). Digital skill adoption and employment dynamics: Evidence from matched vacancy-employer-employee data. *Research Policy*, 55(5), 105476.
24. Kamaruzaman, F. M., Othman, N. N. J. N., Omar, M., & Zaid, M. F. A. M. (2025). Future generic skills for technical vocational education graduates. *International Journal of Learning Teaching and Educational Research*, 24(3), 312-332.
25. Kee, D. M. H., Anwar, A., Gwee, S. L., and Ijaz, M. F. (2023). Impact of acquisition of digital skills on perceived employability of youth: Mediating role of course quality. *Information*, 14(1), Article 42. <https://doi.org/10.3390/info14010042>.
26. Kee, D. M. H., Anwar, A., Shern, L. Y., & Gwee, S. L. (2023). Course quality and perceived employability of Malaysian youth: the mediating role of course effectiveness and satisfaction. *Education and Information Technologies*, 28(10), 13805-13822.
27. Khalila, I. F., Marsofiyati, & Eka Dwi Utari. (2025). Analyzing Students Mastery Of Excel Data Features In Office Administration Education. In *International Journal of Teaching and Learning (INJOTEL)* (Vol. 11, pp. 1149–1161).
28. Lin, Y., & Yu, T. (2023). Exploring spreadsheet proficiency and digital self-efficacy among business students. *Asia Pacific Journal of Business Education*, 5(2), 145–159. <https://doi.org/10.1007/s11846-023-00523-6>
29. Mahmud, M. M., and Wong, S. F. (2022). Digital age: The importance of 21st century skills among the undergraduates. *Frontiers in Education*, 7, Article 950553. <https://doi.org/10.3389/feduc.2022.950553>.
30. Maya Ortiz, E. J. (2025). An Integrated Competency-Based Framework for Employability and the Sustainability of Higher Education. *Sustainability*, 17(22), 10340.
31. Ministry of Communications and Digital. (2021, July 7). Demand for employees with digital skills up by 300%: Noraini. <https://www.komunikasi.gov.my/en/public/news/22294-demand-for-employees-with-digital-skills-up-by-300-noraini>.
32. Nadkarni, S., and Prügl, R. (2021). Digital transformation: A review, synthesis and opportunities for future research. *Management Review Quarterly*, 71, 233–341.
33. Nair, S. (2021). Digital skills key to bolster workforce innovation. *Malaysiakini*. <https://www.malaysiakini.com/announcement/563317>.
34. Nicholas, D. C. J., Dela Cruz, E. A. M., Fino, J. B., Mañao, N. S. S., & Vergara, J. S. S. (2025). Student-Entrepreneurs' level of proficiency in using Microsoft Excel on business data organization and

- cash flow management. *International Journal of Research Publication and Reviews*, 6(3), 2478–2490. <https://ijrpr.com/uploads/V6ISSUE3/IJRPR39891.pdf>
35. Pacheco, P. O., and Coello-Montecel, D. (2023). Does psychological empowerment mediate the relationship between digital competencies and job performance? *Computers in Human Behavior*, 140, Article 107575.
36. Pauceanu, A. M., Rabie, N., & Moustafa, A. (2020). Employability under the fourth industrial revolution. *Economics & Sociology*, 13(3), 269-283.
37. Pegg, A., Waldock, J., Hendy-Isaac, S., & Lawton, R. (2012). Pedagogy for employability.
38. Petrová, K. (2022). The impact of digital technologies on neoclassical labour market. *Danube*, 13(4), 318-330.
39. Pranoto, H., & Sulisty, R. (2024). Embedding advanced Excel tools in business administration curricula: Effects on graduate employability. *Indonesian Journal of Educational Research and Technology*, 4(1), 75–88. <https://doi.org/10.31002/ijert.v4i1.654>
40. Rahmat, A. M., Mohd, I. H., Omar, M. K., Kamalludeen, R., Wan Zahari, W. M. Z., Azmy, N., and Adnan, A. H. M. (2022). Integrating socio-digital skills in the Industry 4.0 era for graduates' employability: An employers' perspective. *Journal of Positive School Psychology*, 6(3), 8493–8507.
41. Retelj, A. (2022). Development of digital competence of future teachers of German as a foreign language at the university of Ljubljana. *Folia linguistica et litteraria*, 13(41), 139-161.
42. Saari, A., Rasul, M. S., Yasin, R. M., Abd Rauf, R. A., Mohamed Ashari, Z. H., and Pranita, D. (2021). Skills sets for workforce in the 4th industrial revolution: Expectation from authorities and industrial players. *Journal of Technical Education and Training*, 13(2), 1–9. <https://doi.org/10.30880/jtet.2021.13.02.001>.
43. Senadjki, A., Au Yong, H. N., Vikniswari, V., Thavamalar, G., and Chitrah, K. (2025). Navigating the digital frontier: A qualitative exploration of digital skills and their impact on Malaysia's digital economy. In A. Senadjki et al. (Eds.), *Proceedings of the 12th International Conference on Business, Accounting, Finance and Economics (BAFE 2024)*, *Advances in Economics, Business and Management Research* (Vol. 317, pp. 310–332). Atlantis Press. https://doi.org/10.2991/978-94-6463-666-6_19.
44. Sozon, M., Roengtam, S., & Yin, Y. (2026). Graduate employability in the AI and globalisation era: implications for higher education institutions. *Journal of Applied Research in Higher Education*, 1-21.
45. Tay, S. I., Alipal, J., and Lee, T. C. (2021). Industry 4.0: Current practice and challenges in Malaysian manufacturing firms. *Technology in Society*, 67, Article 101749. <https://doi.org/10.1016/j.techsoc.2021.101749>
46. Tee, P. K., Song, B. L., Ho, M. K., Wong, L. C., & Lim, K. Y. (2024). Bridging the gaps in digital skills: Employer insights on digital skill demands, micro-credentials, and graduate employability. *Journal of Infrastructure, Policy and Development*, 8(9), 7313.
47. Tee, P. K., Wong, L. C., Dada, M., Song, B. L., and Ng, C. P. (2024). Demand for digital skills, skill gaps and graduate employability: Evidence from employers in Malaysia. *F1000Research*, 13, Article 389. <https://doi.org/10.12688/f1000research.148514.1>.
48. Torres-Coronas, T., & Vidal-Blasco, M. A. (2015). Students and employers perception about the development of digital skills in higher education. *Revista de educación*, (367), 63-90.
49. Turner, L. (2026). Understanding the importance of data analytics in 2026. The Knowledge Academy. <https://www.theknowledgeacademy.com/blog/importance-of-data-analytics/>
50. Vrana, R. (2016, October). Digital literacy as a boost factor in employability of students. In *European Conference on Information Literacy* (pp. 169-178). Cham: Springer International Publishing.
51. Vuorikari, R. (2022, June). DigComp helping shape the education ecosystem in Europe. In *Annual Conference of European Distance and E-Learning Network* (pp. 137-143). Cham: Springer International Publishing.
52. Wee, W. Y. (2023). To understand how digital literacy affect the employability among graduates in Malaysian job market. *Wire Insights: Journal of Innovation Insights*, 1(4), 1–7. <https://academiaone.org/index.php/7/article/view/233>.
53. Widiastuti, R., & Mahadwartha, P. A. (2022). Excel-based performance enhancement during student internships in SMEs. *Jurnal Manajemen dan Kewirausahaan*, 24(1), 67–78. <https://doi.org/10.9744/jmk.24.1.67-78>.

54. Xie, W., and Yang, R. (2025). Exploring the influence of individual digitalization on technostress in Chinese IT remote workers: The mediating role of information processing demands and job complexity. *Acta Psychologica*, 255, Article 104882.
55. Zhou, X., Wolstencroft, P., Schofield, L. N., & Fang, L. (2025). Are Graduates Digitally Unprepared?—A Digital Technology Gap Analysis From Alumni and Employer's Perspectives. *Journal of Computer Assisted Learning*, 41(4), e70046.