ISSN 2732-3781 https://doi.org/10.52398/gjsd.2026.v6.i2.pp21-44

GILE Journal of Skills Development

Shaping the Future of Accounting Education: A Literature Review of Accountant 4.0 Competencies

Vanissla Hutzli

Geneva School of Business Administration (HEG-Genève), HES-SO University of Applied Sciences and Arts Western Switzerland; TECFA, Faculty of Psychology and Educational Sciences, University of Geneva, Switzerland
ORCID: https://orcid.org/0009-0009-8400-8838

Catherine Equey

Geneva School of Business Administration (HEG-Genève), HES-SO University of Applied Sciences and Arts, Western Switzerland
ORCID: https://orcid.org/0000-0002-9226-4163

Giulia Ortoleva

TECFA, Faculty of Psychology and Educational Sciences, University of Geneva, Switzerland
ORCID: https://orcid.org/0009-0007-2623-2829

Mireille Bétrancourt

TECFA, Faculty of Psychology and Educational Sciences, University of Geneva, Switzerland
ORCID: https://orcid.org/0000-0001-7144-167X

Abstract

The rapid development of digital technologies is transforming the accounting profession and the competencies required to practise it. Consequently, higher education institutions face increasing pressure to prepare students and graduates for evolving professional roles and to align accounting curricula with changing labour market expectations. Identifying the competencies required in a technology-enabled accounting profession is therefore particularly relevant to the preparation and professional development of future and early-career accounting professionals. This study identifies the competencies associated with the Accountant 4.0 and examines how frequently they are identified in academic and professional literature. A structured literature review was conducted, including 47 academic publications and documentary sources associated with 14 professional accounting organisations. The findings reveal differences in the frequency with which competencies are identified across the two bodies of literature. Academic publications most frequently identify general technological skills and understanding, problem-solving, communication, and teamwork. The professional corpus covers a broader range of competencies, with technical accounting competencies, general

technological skills and understanding, data analytics, ethics, integrity and professionalism, and analytical reasoning among the most frequently identified. Communication and teamwork are among the competencies frequently identified across both academic and professional sources. By integrating and systematically comparing academic and professional perspectives, this study provides a consolidated overview of Accountant 4.0 competencies and identifies areas of convergence and divergence between the two bodies of literature. The findings provide a basis for reflecting on how accounting education can support the competency development of students, graduates, and early-career professionals as they prepare for a profession increasingly shaped by digital transformation.

***Keywords*:** accounting education, accounting competencies, digital transformation, accounting graduates, accountant 4.0

1. Introduction

The growing use of digital technologies and Artificial Intelligence (AI) is automating repetitive tasks and transforming how people work and interact with technology (OECD, 2019). These developments are associated with the Fourth Industrial Revolution or Industry 4.0 (Németh et al., 2021). While automation may allow workers to focus on higher value-added activities requiring cognitive skills and human expertise, routine jobs remain particularly exposed (Elo, 2025; Kee, 2024).

These transformations have important implications for skills development. Forecasts suggest that approximately 39% of workers' existing skill sets are expected to change or become outdated between 2025 and 2030, while AI and big data are among the fastest-growing skills in demand (World Economic Forum, 2025). Changes in required skill sets can contribute to what is commonly referred to as a "skill gap," understood as a discrepancy between the competencies possessed by workers and those required by employers (Bui & Porter, 2010; Edeigba, 2022; Elo, 2025; Jackling & De Lange, 2009). Skills gaps are identified by 63% of employers as a major barrier to business transformation, making them the most frequently reported barrier to organisational change (World Economic Forum, 2025).

Accounting is particularly affected because many routine accounting tasks are susceptible to automation (Elo, 2025). Digitalisation is expected to shift the accountant's traditional role towards more strategic activities involving decision-making and information systems management (Elo, 2025). Existing research suggests that required competencies in the accounting field are becoming more complex, encompassing not only data analysis and the use of new technologies, but also social and cognitive competencies (Elo, 2025; García & de los Ríos, 2021; Handoyo, 2024; Razali et al., 2022; Rosi & Mahyuni, 2021).

Drawing on this literature, the term "Accountant 4.0" refers in this study to an accounting professional who combines technical accounting expertise with the digital, intellectual, interpersonal, and other professional competencies required to operate in a technology-enabled environment (Razali et al., 2022; Stancheva-Todorova, 2020). Identifying these competencies more precisely provides higher education institutions with a basis for examining how they are represented in accounting curricula and which may warrant greater attention. It may also help students and graduates reflect on the competencies they need to strengthen when transitioning

into professional practice (Crosta et al., 2023; Soproni, 2023), and support continued development as professional requirements evolve.

Academic research and professional competency frameworks provide complementary perspectives on the competencies required of future accounting professionals. Academic publications examine how these competencies are conceptualised and investigated, whereas professional frameworks reflect expectations associated with accounting practice (Elo et al., 2023; García & de los Ríos, 2021; Handoyo, 2024; Rosi & Mahyuni, 2021).

Accordingly, this study identifies the competencies associated with the Accountant 4.0 and compares their frequency in academic publications and across professional accounting organisations. A structured literature review integrates 47 academic publications and sources associated with 14 professional organisations within a common classification. By comparing patterns of coverage without treating frequency as a measure of importance, the study provides a consolidated overview and a basis for considering how accounting education can support competency development and the transition to professional practice.

2. Literature Review

2.1. From Industry 4.0 to Accountant 4.0

Industry 4.0 emerged from a German high-technology strategy aimed at promoting the computerisation of production. It now refers more broadly to the integration of intelligent digital technologies, including the Internet of Things, artificial intelligence, big data, and robotics. It encompasses the digital integration of value chains, the digitalisation of products and services, and the development of innovative digital business models (Dašić & Anufrijev, 2025). Its implications therefore extend beyond the adoption of technological tools, as it also transforms organisational processes, workforce competencies, and education (Németh et al., 2021).

Applied to accounting, Industry 4.0 is associated with a transition from conventional accounting practices towards increasingly automated and systematic processes. Although technologies can organise and process financial data, accountants remain responsible for evaluating the information produced and contributing to activities requiring human judgement, resulting in new forms of human–technology collaboration (Razali et al., 2022). The Accountant 4.0 is described as a hybrid professional combining accounting expertise with interdisciplinary knowledge and diversified competencies encompassing digital technologies, big data and data analytics, robotics and artificial intelligence, cybersecurity, taxation, and legal and statutory requirements (Stancheva-Todorova, 2020). More broadly, the literature emphasises the need to combine technical and ethical competence with digital, analytical, communication, leadership, and adaptability skills (Razali et al., 2022).

The term “Accountant 4.0” therefore denotes a multidimensional competency profile rather than a distinct occupational title. In this study, it encompasses the technical, digital, intellectual, interpersonal, and other professional competencies that allow accounting professionals to use technological tools, interpret their outputs, exercise professional judgement, and contribute to organisational decision-making.

2.2. Definition of Competency

Competency can be defined as an individual's ability to mobilise and combine resources, such as knowledge and skills, to deal with a specific professional situation within a particular context. Individuals must adapt to respond to the constraints and requirements of the situation (Le Boterf, 2010; Mulder, 2014). It extends beyond the possession of knowledge to its appropriate application in context (El Asame & Wakrim, 2018; Le Boterf, 2010; Mulder, 2014). Competency also involves initiative and adaptation in response to professional demands (Zarifian, 2001). It develops through experience and reflection and cannot be reduced to knowledge or assessed solely through observable performance (Charlier & Deschryver, 2011).

2.3. Competency Gaps and Competency Frameworks

Higher education institutions are expected to prepare graduates whose competencies align with professional expectations (Elo, 2025; Kee, 2024). Insufficient alignment may create competency gaps, also described as skill gaps or expectation–performance gaps (Bui & Porter, 2010; Edeigba, 2022; Elo et al., 2023; Jackling & De Lange, 2009; Razali et al., 2022). Although digital transformation has renewed attention to this issue, discrepancies between accounting education and professional expectations have long been documented (Bui & Porter, 2010; Jackling & De Lange, 2009).

Existing reviews identify professional, soft, digital, and strategic competencies, persistent differences between employer expectations and graduate competencies, and curriculum reform and work-integrated learning as possible responses (Nie & Mastor, 2024). An earlier meta-synthesis similarly highlighted technological change and the evolving mix of competencies required in accounting work (Rosi & Mahyuni, 2021).

These concerns have encouraged professional bodies to broaden their competency frameworks. The need for such developments is illustrated by the limited curriculum coverage of data analytics, cybersecurity, IT auditing and governance, digital acumen, and control systems identified across 317 universities (AICPA & NASBA, 2021a, 2021b).

Professional standards, competency frameworks, and qualification syllabi increasingly present professional competence as multidimensional. Technical accounting knowledge remains central but is combined with intellectual, interpersonal, communication, ethical, leadership, employability, and digital competencies. This broader conception is reflected in the International Education Standards (IESs) issued by the International Federation of Accountants (IFAC), which address technical competence, professional skills, and professional values, ethics, and attitudes (IFAC, 2025a, 2025b, 2025c). It is also apparent in the integration of professional judgement, information interpretation, communication, employability, and technology within the Strategic Business Reporting syllabus, and in the organisation of professional competence into Technical, Business, People, Leadership, and Digital Skills (ACCA, 2024; AICPA & CIMA, 2023). Despite differences in terminology and purpose, these documents therefore converge towards a conception of professional competence that extends beyond technical accounting knowledge.

From an academic perspective, accounting students' perceptions of the future importance of 31 competencies and their development during their studies were examined by Elo et al. (2023). The competencies were organised into five categories: technical skills and knowledge;

computer, information technology, and data processing skills; intellectual skills; interpersonal, social and communication skills; and other professional skills. Expectation–performance gaps were identified for most competencies, particularly in technological and data-processing areas. This study therefore provides both a comprehensive classification and an educational perspective on competencies requiring further development.

These categories extend beyond technical and digital expertise. Communication, teamwork, problem-solving, and other transferable competencies also contribute to accounting graduate employability and career readiness (de Lange et al., 2023; Imjai et al., 2025; Nesbit et al., 2023).

In the absence of a universally accepted classification, the five categories proposed by Elo et al. (2023) are retained as the organising structure for the present study and are complemented with the more detailed, practice-oriented competencies included in the AICPA & CIMA (2023) framework. The present study does not replicate the original assessment of expected importance and perceived development. Instead, it aims to apply this five-category organising structure to an expanded set of competency entries and to compare how frequently they are identified across academic publications and professional accounting organisations.

3. Methodology

3.1. Research Objective and Review Approach

This study addresses the following research questions:

1. What competencies are associated with the Accountant 4.0 in academic publications and professional accounting documents?
2. How often are these competencies identified in academic publications and across professional accounting organisations?

A structured literature review and documentary analysis were used to compare academic and practice-oriented perspectives without collecting primary data. The academic search was restricted to publications issued between January 2023 and August 2025 to capture recent competency requirements in a professional environment increasingly shaped by generative AI and digital transformation since the end of 2022 (World Economic Forum, 2023).

3.2. Literature Search and Selection Process

Google Scholar was selected for its broad multidisciplinary coverage across accounting, education, technology, and employability, an approach also used by Rosi and Mahyuni (2021). Predefined eligibility criteria and sequential screening from titles to abstracts and full texts drew on Nie and Mastor (2024).

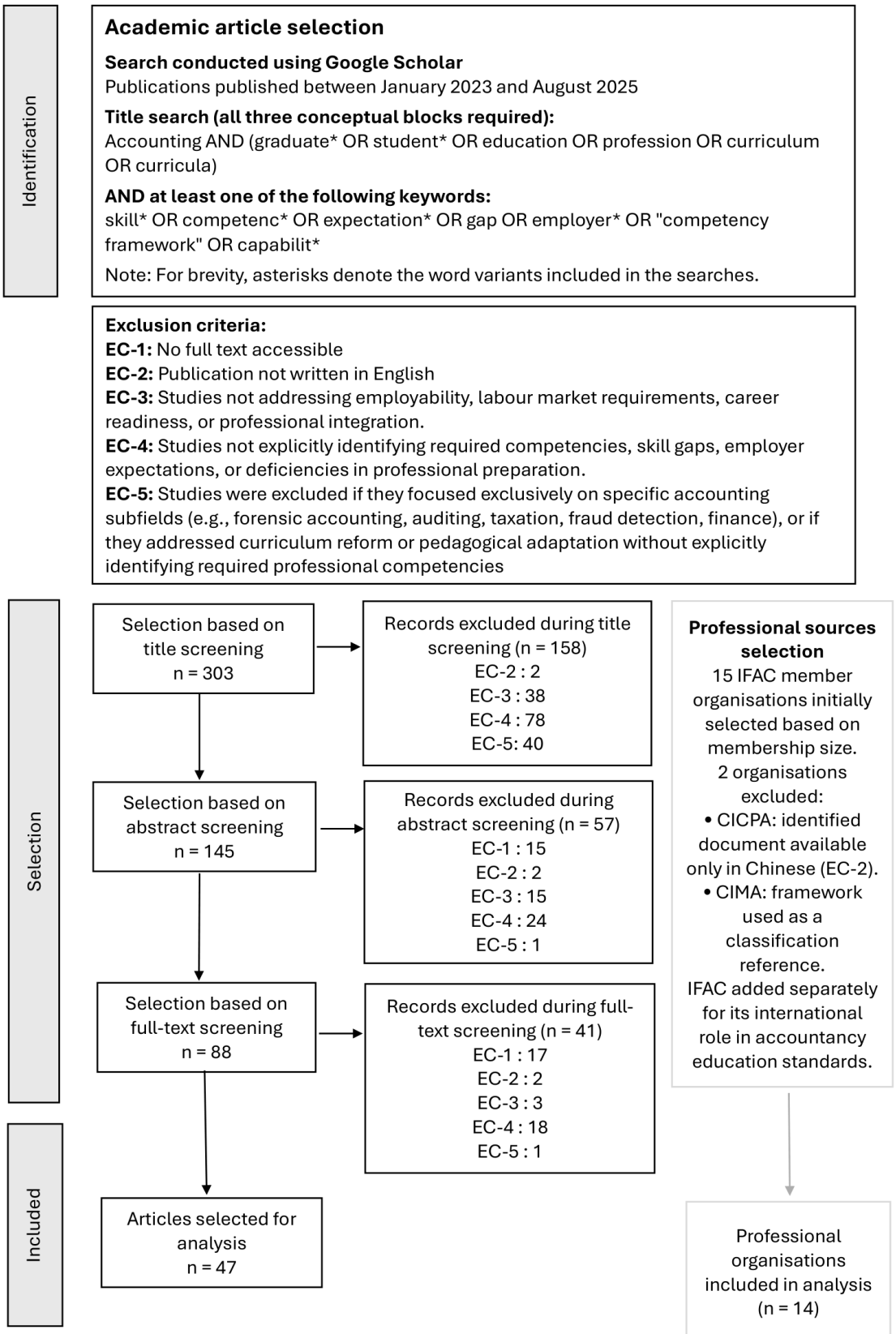
The search string was developed by the first author with one co-author to reflect terminology used across accounting education and professional literature. It comprised three conceptual blocks: accounting; the educational or professional context (graduates, students, education, profession, or curricula); and competency requirements (skills, competencies, expectations, gaps, employers, frameworks, or capabilities). Synonyms were connected by OR and truncated terms captured variants, while AND required all three blocks. The title restriction ensured that competency requirements were an explicit focus. Figure 1 presents the complete string and exclusion criteria.

Records were screened sequentially using predefined criteria. The title search focused on publications explicitly addressing accounting competencies, education, graduates, or professional skill requirements. Records were initially classified as eligible, ineligible, or uncertain, with uncertain records retained for abstract assessment. The remaining full texts were then examined to determine final inclusion. Screening decisions and exclusion criteria were documented in a structured spreadsheet.

The search yielded 303 initial records, of which 47 academic publications ultimately met the eligibility criteria. Despite the focused search strategy and short publication window, this corpus is comparable in size to the reviews of Rosi and Mahyuni (2021) and Nie and Mastor (2024), which retained 40 and 45 publications, respectively.

Professional sources were included to complement academic perspectives on accounting competencies. Fifteen of the largest IFAC member organisations were initially selected by comparing reported membership figures. CICPA was excluded because the identified document was available only in Chinese. The AICPA & CIMA (2023) framework and the study by Elo et al. (2023) were used as reference sources to construct the 53-entry classification. To avoid coding these sources against a classification they had helped define, CIMA was not counted among the professional organisations analysed, and Elo et al. (2023) was not included among the 47 academic publications. IFAC was added as a separate organisational unit because of its international role in accountancy education standards, resulting in a final corpus of 14 professional organisations. The jointly authored Singaporean framework, which includes ISCA, is cited as SkillsFuture Singapore et al. (2020). Selection was based on membership size rather than geography, although the final corpus covers several world regions.

FIGURE 1. ARTICLE SEARCH AND SELECTION PROCESS



Source: created by the authors

The 47 academic publications and the documentary sources associated with the 14 professional organisations are presented in Table 1.

TABLE 1. ACADEMIC AND PROFESSIONAL SOURCES USED IN THE REVIEW

Academic sources	Professional sources
(Abdalla, 2023; Abubaker et al., 2024; Afni et al., 2024; Alia & Lestari, 2025; Askary & Askarany, 2024; Awang et al., 2023; Blasco Burriel et al., 2023; Bunea & Guinea, 2023; Calumpiano, 2023; Chandler, 2024; Dašić & Anufrijev, 2025; Davies & Sparkes, 2024; de Lange et al., 2023; Duong et al., 2023; Ghani et al., 2024; Giang, 2024; Gyekye & Amo, 2024; Haidar & Al-Shorafa, 2023; Hussin et al., 2023; Ikpeama et al., 2025; Imjai et al., 2025; Januszewski et al., 2024; Koko & Ajinwo, 2023; Koko & Elekwachi, 2023; Kotze & Miller, 2023; Lima & de Lima, 2025; Lkhagvasuren et al., 2023; Lleshaj & Çika, 2023; Manira & Effendy, 2024; Micallef et al., 2023; Moran, 2025; Muliati & Indriani, 2024; Nesbit et al., 2023; Nwalado et al., 2024; Nwaogazie et al., 2024; Ordu & Adama, 2025; Puriboriboon, 2025; Rhodes, 2023; Rkein et al., 2024; Taib et al., 2023; Thi & Ngoc, 2024; Tiron-Tudor et al., 2025; Twyford & Dean, 2024; Ugwunwoti et al., 2025; van den Berg & Rothmann, 2024; Yunos et al., 2023; Zhang et al., 2025)	(ACCA, 2024; AICPA & NASBA, 2021a, 2021b; CA ANZ, 2024; CPA Australia, n.d.-a, n.d.-b; CPA Canada, 2022; HKICPA, 2019; ICAEW, 2025; ICAI, n.d.-a, n.d.-b, n.d.-c; ICAS, 2024, 2025; IFAC, 2025a, 2025b, 2025c; IMA, 2022; IPA, n.d.; SkillsFuture Singapore et al., 2020; SAICA, 2022, 2023)

Source: created by the authors

3.3. Classification of Competencies

The competencies were classified using Elo et al. (2023) and AICPA & CIMA (2023). The five categories proposed by Elo et al. provided the organising structure, complemented by the more detailed practice-oriented content of the professional framework. The first author and one co-author independently mapped the two sources and resolved differences concerning equivalence, grouping, and classification through discussion.

The resulting classification comprises 53 entries across five categories: technical (20); technological and data-processing (11); intellectual (5); interpersonal, social, and communication (7); and other professional competencies (10). Entries include both specific competencies and broader competency categories. In particular, "Strategy" and "Business relations" retain the original AICPA & CIMA (2023) labels and represent categories encompassing individual capabilities described in that framework. The categories are used as descriptive organisational tools rather than rigid analytical divisions (Charlier & Deschryver, 2011).

Overarching entries are shown in bold and marked with an asterisk in Table 2. Broad references such as “accounting skills” were classified under “Financial administration/accounting skills and theoretical understanding”. More specific references were classified under the relevant sub-competency and also counted within the overarching entry. Partial references such as “reporting” were assigned to the corresponding broader competency.

Each academic publication constituted one unit of analysis. Professional documents associated with the same organisation were consolidated so that each organisation also constituted one unit. A competency was counted once per publication or organisation, regardless of repeated mentions or the number of associated documents. Table 2 provides the competency identifiers (No.) used in the heatmaps, while the complete source-by-competency coding matrix is available as Supplementary Material.

TABLE 2. CLASSIFICATION OF ACCOUNTANT 4.0 COMPETENCIES

No.	Competency	No.	Competency
	Technical skills and knowledge		**Technical skills and knowledge**
1	**Financial administration / accounting skills and theoretical understanding***	12	Process management
2	Financial accounting and reporting	13	Project management
3	Cost accounting and management	14	Macroeconomic analysis
4	Business planning	15	Market and regulatory environment
5	Management reporting and analysis	16	Business relations
6	Corporate finance and treasury management	17	Business ecosystems management
7	Risk management and internal control		Other technical skills and knowledge
8	Tax strategy, planning and compliance	18	Juridical knowledge
9	**Knowledge of different fields, understanding the big picture. Business skills***	19	Foreign languages
10	Strategy	20	Research methodology and statistics
11	Business models		
	Computer, IT and data processing skills		**Intellectual skills**
21	Knowledge related to robotics and artificial intelligence	32	Analytical reasoning
22	Different IT systems	33	Decision making
23	Accounting information systems	34	Critical thinking
24	General technological skills and understanding	35	Problem solving
25	Programming	36	Logical and mathematical reasoning
26	Digital content creation		
27	Information and digital literacy		
28	**Data processing***		
29	Data strategy and planning		
30	Data visualisation		
31	Data analytics		
	Interpersonal, social and communication skills		**Other professional skills**
37	Communication (oral and writing)	44	Innovation skills and innovativeness
38	Active listening	45	General leadership skills (coaching, mentoring, motivating and inspiring)
39	Networking, collaboration and partnering	46	Media literacy and criticism
40	Emotional intelligence and influence	47	Self-improvement and learning
41	Teamworking/building and interaction skills	48	Driving performance, self-management
42	Negotiation	49	Working under pressure
43	Customer service	50	Adaptability and flexibility
		51	Initiative skills
		52	Ethics, integrity and professionalism
		53	Change management

Source: authors' classification based on Elo et al. (2023) and AICPA & CIMA (2023)

Note: Numbers correspond to the competency identifiers in the heatmaps. Asterisks indicate overarching entries encompassing items 2–8, 10–17, and 29–31, respectively.

3.4. Visualisation of Competencies

Two heatmaps visualise competency coverage across the corpora (Figures 2 and 3). Colours distinguish the five categories, while filled cells indicate the presence of a competency in each source. Following the visualisation approach of Hangyál et al. (2026), frequencies of 75–100% are highlighted in green and those of 50–74% in yellow.

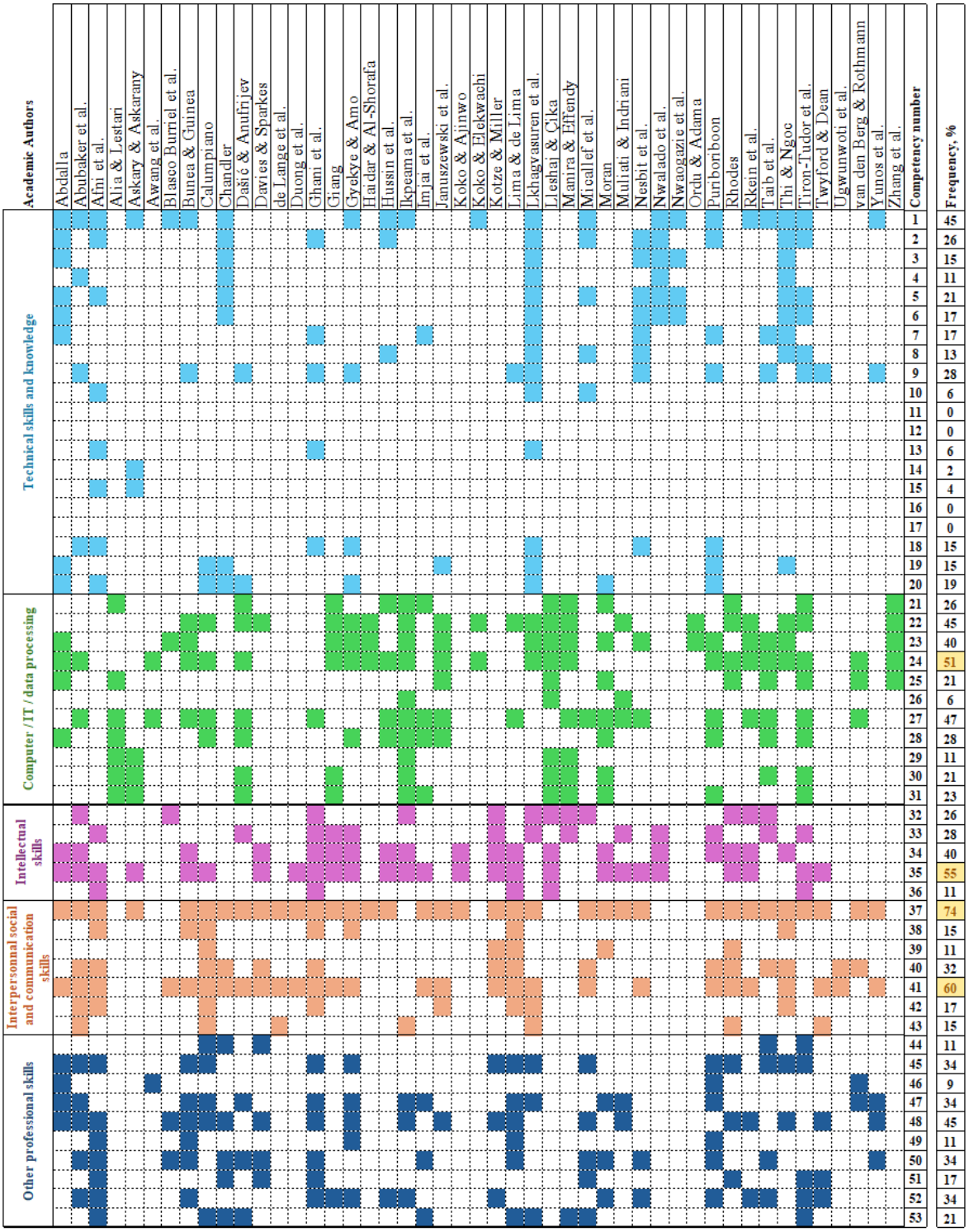
4. Results

4.1. Competencies Identified in Academic Publications

The academic publications displayed relatively selective competency coverage. Only four competencies appeared in at least half of the corpus: communication (No. 37; 74%), teamworking/building and interaction skills (No. 41; 60%), problem-solving (No. 35; 55%), and general technological skills and understanding (No. 24; 51%).

Technical accounting competencies were less frequent. The overarching entry covering financial administration, accounting skills, and theoretical understanding (No. 1) appeared in 45% of the publications, while individual technical entries generally appeared in fewer than 30%. Driving performance and self-management (No. 48) was the most frequent other professional competency at 45%.

FIGURE 2. HEATMAP OF COMPETENCIES IDENTIFIED IN ACADEMIC PUBLICATIONS



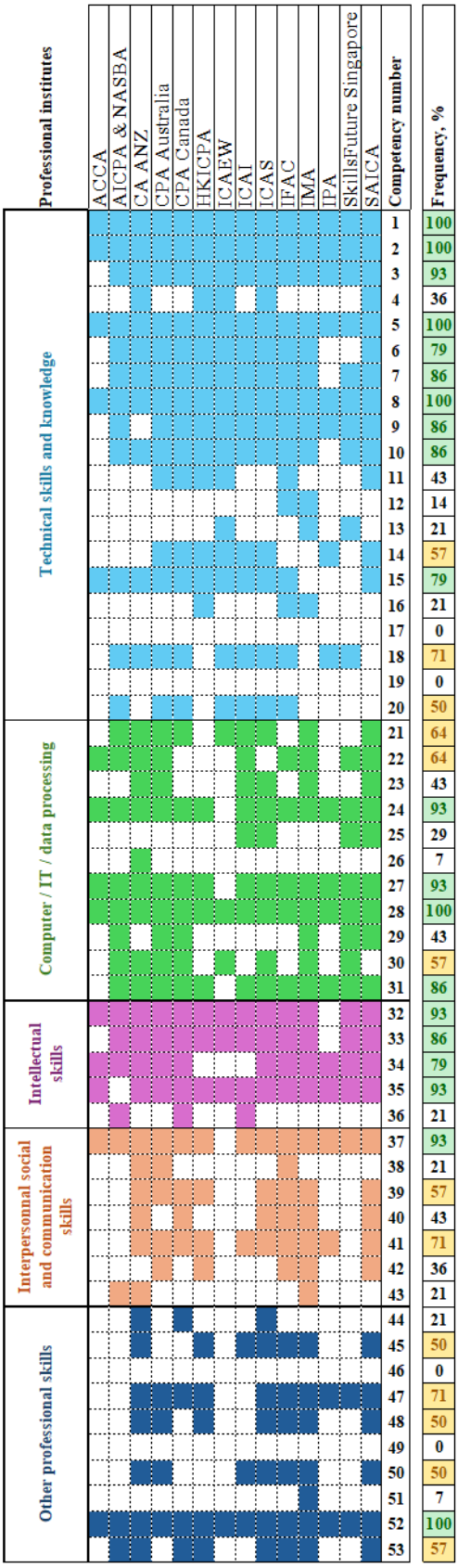
Source: created by the authors

4.2. Competencies Identified by Professional Organisations

Professional organisations covered a broader range of competencies, with 13 of the 20 technical entries appearing in at least half of the corpus. Financial administration and accounting skills (No. 1), financial accounting and reporting (No. 2), management reporting and analysis (No. 5), and tax strategy, planning and compliance (No. 8) appeared in all organisations.

Digital and intellectual competencies were also prominent. Data processing (No. 28) appeared in all organisations, while general technological skills and understanding (No. 24), information and digital literacy (No. 27), analytical reasoning (No. 32), and problem-solving (No. 35) each reached 93%. Communication (No. 37) reached 93%, teamworking/building and interaction skills (No. 41) reached 71%, and ethics, integrity and professionalism (No. 52) appeared in all organisations.

FIGURE 3. HEATMAP OF COMPETENCIES IDENTIFIED BY PROFESSIONAL ORGANISATIONS



Source: created by the authors

4.3. Comparison of Academic and Professional Sources

Communication (No. 37), teamworking/building and interaction skills (No. 41), general technological skills and understanding (No. 24), and problem-solving (No. 35) represent the clearest areas of convergence, as they appeared in a majority of both corpora. Important differences nevertheless emerged. Data processing (No. 28) appeared in all professional organisations but in only 28% of academic publications, while ethics, integrity and professionalism (No. 52) appeared in all organisations but in 34% of academic publications. Overall, professional organisations covered broader competency profiles, whereas academic publications generally focused on narrower sets.

5. Discussion

The findings support the multidimensional conception of the Accountant 4.0 identified in previous research. Rather than replacing traditional accounting expertise, the profile combines technical knowledge with technological literacy, analytical capabilities, interpersonal competencies, ethics, and professional judgement. This is consistent with descriptions of the Accountant 4.0 as a hybrid professional requiring diversified and interdisciplinary competencies (Razali et al., 2022; Stancheva-Todorova, 2020).

The broader coverage observed among professional organisations may reflect the comprehensive purpose of professional competency frameworks and qualification documents, which are generally intended to define profiles applicable across multiple accounting roles. Their emphasis on technical accounting, data-related competencies, analytical reasoning, and ethics is consistent with previous research highlighting the continued importance of accounting expertise alongside digital, analytical, and ethical competencies (Razali et al., 2022; Stancheva-Todorova, 2020). Academic publications, by contrast, generally examine more specific competency areas. Their stronger focus on general technological skills, communication, teamwork, and problem-solving is consistent with previous Industry 4.0 and accounting employability research combining digital capabilities with decision-making, adaptability, communication, teamwork, and continuous learning (Dašić & Anufrijev, 2025; de Lange et al., 2023; Imjai et al., 2025; Nesbit et al., 2023; Nie & Mastor, 2024).

Communication, teamwork, problem-solving, and general technological skills represent the clearest areas of convergence. This suggests that evolving accounting work requires technological capabilities alongside competencies dependent on human interaction and judgement. However, differences in frequency may reflect the scope and purpose of the documents rather than the importance assigned to individual competencies.

These findings also complement those of Elo et al. (2023), who reported high expected importance for general technological skills, critical thinking, and problem-solving, together with expectation–performance gaps across most competencies, particularly in technological and data-processing areas. Whereas their study compared students' perceptions of expected importance and perceived development, the present study examines the frequency with which competencies are identified across academic and professional sources. The two approaches therefore provide complementary perspectives on competencies that may warrant attention in accounting education.

By integrating academic and professional perspectives within a common classification, the study provides a broader view of Accountant 4.0 competencies than either corpus considered separately. However, it does not demonstrate a gap between accounting education and professional expectations because academic publications do not directly represent curricula and professional sources do not necessarily reflect individual employers' requirements.

5.1. Practical Implications

The classification provides higher education institutions and accounting educators with a basis for examining how the identified competencies are represented in curricula. Curriculum mapping could identify competencies that are already developed, could be reinforced, or may require greater attention. The findings particularly support combining communication, teamwork, and problem-solving with technical accounting and digital competencies.

The classification may also help students and graduates identify competencies to strengthen when entering professional practice. Nevertheless, it does not prescribe a universal curriculum, as competency requirements, professional roles, and educational structures vary across contexts.

6. Conclusion

This study integrated 47 academic publications and sources associated with 14 professional accounting organisations to classify 53 Accountant 4.0 competencies and compare their frequency. Professional sources generally covered broader competency profiles, whereas academic publications addressed narrower sets. Their convergence on technological, problem-solving, communication, and teamwork competencies provides a basis for curriculum reflection, without demonstrating a direct gap between accounting education and professional expectations.

6.1. Limitations and Future Research

Several limitations should be considered. The different purposes of academic and professional sources may have influenced the observed frequencies. Google Scholar's dynamic indexing and less standardised search functions may limit reproducibility or omit relevant publications, while the academic search covered only January 2023 to August 2025. Professional sources were restricted to English and organisations selected according to IFAC membership and membership size rather than geographical balance. Screening and coding were conducted by the first author, although the two reference classifications were mapped with one co-author. Finally, frequency measures how widely a competency was identified but not its importance, required proficiency level, or presence in accounting curricula.

Future research could use structured databases such as Scopus and Web of Science, extend the publication period, include additional languages, and involve multiple researchers in screening and coding. Empirical studies could examine curricula, competencies developed by students and graduates, and proficiency levels expected by employers to determine whether the patterns identified correspond to actual gaps between education and professional requirements.

Overall, the study provides a consolidated view of Accountant 4.0 competencies and a foundation for curriculum reflection, competency development, and further research on the transition from accounting education to professional practice.

References

Abdalla, R. (2023). The important accounting graduates skills for the Libyan job market: Perceptions of academics and professionals. *Journal of Management and Business Education*, *6*(3), 305–329. https://doi.org/10.35564/jmbe.2023.0016

Abubaker, N. M. B., Ahmed, A. A. K., Mousa, A. B. A., & Ismail, Z. A. (2024). Assessing the contribution of accounting education in Saudi public universities to students' professional skills development: A study in light of International Accounting Education Standards 3 (IES3). *Pakistan Journal of Life and Social Sciences (PJLSS)*, *22*(2), 9214–9228. https://doi.org/10.57239/PJLSS-2024-22.2.00697

ACCA. (2024). *Strategic Business Reporting (SBR-IRL): Syllabus and study guide, September 2024 to June 2025*. https://www.accaglobal.com/content/dam/acca/global/PDF-students/acca/SBR/ SBR-IRL%20S24-J25%20syllabus%20and%20study%20guide%20-%20final.pdf

Afni, Z., Dwiharyadi, A., & Saura, R. (2024). Aligning accounting education with industry demands: Bridging competency gaps for the future of auditing and financial services. *The International Journal of Business Review (The Jobs Review)*, *7*(2), 165–172. https://doi.org/10.17509/tjr.v7i2.63966

AICPA & CIMA. (2023). *CGMA Competency Framework – 2023 Update*. https://assets.ctfassets.net/rb9cdnjh59cm/6y9Yg11nDD3zVGN6zKnepW/73f09b930950218f06aabd2b8fd0415c/cgma-competency-framework-2023-edition.pdf#page=29.07

AICPA & NASBA. (2021a). *Accounting Program Curriculum Gap Analysis Report*. https://evolutionofcpa.org/Documents/Accounting%20Program%20Curriculum%20Gap%20Analysis%20Report%203.15.2021.pdf

AICPA & NASBA. (2021b). *CPA evolution model curriculum*. https://nasba.org/wp-content/uploads/2021/06/Model-curriculum_web_6.11.21.pdf#page=90.99

Alia, A., & Lestari, B. A. H. (2025). Revolutionizing the accounting curriculum: Optimizing accountant competencies through data technology, blockchain, and artificial intelligence from the perspective of accounting students at the University of Mataram in Industry 5.0. *Asian Journal of Applied Business and Management*, *4*(1), 341–354. https://doi.org/10.55927/ajabm.v4i1.84

Askary, S., & Askarany, D. (2024). Analytical skills for accounting students in a data-driven job market: Australian evidence. *Accounting Research Journal*, *37*(6), 635–654. https://doi.org/10.1108/ARJ-05-2024-0184

Awang, Y., Taib, A., Shuhidan, S. M., Zakaria, Z. N. Z., Ifada, L. M., & Sulistyowati, S. (2023). Mapping between digital competencies and digitalization of the accounting profession among postgraduate accounting students. *Asian Journal of University Education*, *19*(1), 83–94. https://doi.org/10.24191/ajue.v19i1.21226

Blasco Burriel, M. P., Costa Toda, A., & Labrador Barrafón, M. (2023). Competencias relevantes en contabilidad. La perspectiva de estudiantes y empleadores [Relevant competencies in accounting: The perspective of students and employers]. *Revista de Contabilidad*, *26*(1), 150–163. https://doi.org/10.6018/rcsar.416001

Bui, B., & Porter, B. (2010). The expectation-performance gap in accounting education: An exploratory study. *Accounting Education*, *19*(1–2), 23–50. https://doi.org/10.1080/09639280902875556

Bunea, S., & Guinea, F.-A. (2023). Stakeholders' perceptions of the vocational competences acquired by students enrolled in accounting master's programmes in Romania. *Sustainability*, *15*(9), 7406. https://doi.org/10.3390/su15097406

CA ANZ. (2024). *CA Capability Model*. https://www.charteredaccountantsanz.com/learning-and-events/learning/capability-model

Calumpiano, D. A. C. (2023). Employability skills and performance of accounting graduates in the workplace. *Russian Law Journal*, *11*(6s), 201–207. https://doi.org/10.52783/rlj.v11i6s.921

Chandler, N. (2024). Shifting work competencies in an emerging economy: A comparison of accounting students' perceptions of demand and supply. *Higher Education, Skills and Work-Based Learning*, *15*(7), 1–15. https://doi.org/10.1108/HESWBL-08-2023-0213

Charlier, B., & Deschryver, N. (2011). Développer et évaluer des compétences dans l'enseignement supérieur: Réflexions et pratiques. *Éducation & Formation*, (e-296), 9–12.

CPA Australia. (n.d.-a). *Appendix 2: Required competency areas and learning outcomes*. Retrieved 4 July 2025, from https://www.cpaaustralia.com.au/get-involved/academic-institution-support/professional-accreditation-guidelines/appendix-2-technical-competency-areas-and-learning-outcomes

CPA Australia. (n.d.-b). *Appendix 3: Professional competency areas and learning outcomes*. Retrieved 4 July 2025, from https://www.cpaaustralia.com.au/get-involved/academic-institution-support/professional-accreditation-guidelines/appendix-3-professional-competency-areas-and-learning-outcomes

CPA Canada. (2022). *Tracer la voie pour l'avenir de la profession: La grille de compétences 2.0*. https://cdn-ca.aglty.io/comp-map-2/Attachments/NewItems/Grille%20de%20comp%C3%A9tences%20CPA%202.0.pdf

Crosta, L., Banda, V., & Bakay, E. (2023). 21st century skills development among young graduates: A European perspective. *GILE Journal of Skills Development*, *3*(1), 40–56. https://doi.org/10.52398/gjsd.2023.v3.i1.pp40-56

Dašić, G., & Anufrijev, A. (2025). The Industry 4.0 and the necessary competences and knowledge in the modern environment on the example of the accounting profession. *Serbian Journal of Engineering Management*, *10*(1), 57–67. https://doi.org/10.5937/SJEM2501057D

Davies, M., & Sparkes, D. (2024). Employability skills development for undergraduate accounting students using a business simulation game: A case study of the use of Accounting BISSIM. *Developments in Business Simulation and Experiential Learning*, *51*, 265–277.

de Lange, P., O'Connell, B. T., Tharapos, M., Beatson, N., & Oosthuizen, H. (2023). Accounting graduate employability: Employer perspectives on skills and attributes of international graduates. *Accounting Education*, *32*(3), 249–277. https://doi.org/10.1080/09639284.2022.2059383

Duong, T. Q. L., Nguyen, T. H. D., Nguyen, T. H. T., Dinh, T. T. S., Nguyen, T. Q., Le, A. Q., & Bui, T. D. (2023). The role of soft skills for students accounting industry in the concept of digital transformation by output standard accessories. *Cross Current International Journal of Economics, Management and Media Studies*, *5*(02), 21–27. https://doi.org/10.36344/ccijemms.2023.v05i02.002

Edeigba, J. (2022). Employers' expectations of accounting skills from vocational education providers: The expectation gap between employers and ITPs. *The International Journal of Management Education*, *20*(3), 100674. https://doi.org/10.1016/j.ijme.2022.100674

El Asame, M., & Wakrim, M. (2018). Towards a competency model: A review of the literature and the competency standards. *Education and Information Technologies*, *23*(1), 225–236. https://doi.org/10.1007/s10639-017-9596-z

Elo, T. (2025). *An evolving landscape and skill requirements of the accounting profession: A multi-stakeholder perspective* [Doctoral dissertation, LUT University]. https://lutpub.lut.fi/bitstream/handle/10024/169644/Tytti%20Elo_A4.pdf?sequence=5&isAllowed=y

Elo, T., Pätäri, S., Sjögrén, H., & Mättö, M. (2023). Transformation of skills in the accounting field: The expectation–performance gap perceived by accounting students. *Accounting Education*, *33*(3), 237–273. https://doi.org/10.1080/09639284.2023.2191289

García, J. L., & de los Ríos, I. (2021). Model to develop skills in accounting students for a 4.0 industry and 2030 agenda: From an international perspective. *Sustainability*, *13*(17), Article 17. https://doi.org/10.3390/su13179699

Ghani, E. K., Ilias, A., Muhammad, K., Rosley, N. A., Mohd Ali, M., & Sukmadilaga, C. (2024). Expectation gap on accounting graduates' skill attributes between accounting educators and employers in Industry 4.0 environment: A Malaysian evidence. *Educational Administration: Theory and Practice*, *30*(3), 1–15. https://doi.org/10.52152/kuey.v30i3.1059

Giang, T. H. (2024). Enhancing professional skills for accounting students to meet the program's graduation standards. *European Journal of Contemporary Education and E-Learning*, *2*(3), 226–246. https://doi.org/10.59324/ejceel.2024.2(3).19

Gyekye, K., & Amo, O. (2024). Quality of accounting graduates and employers' expectations in Ghana. *Journal of International Education in Business*, *17*(3), 395–415. https://doi.org/10.1108/JIEB-07-2023-0044

Haidar, F. T., & Al-Shorafa, A. J. (2023). Employers' needs of accounting graduates skills in the Saudi labor market: Analytical study. *Journal of Organizational Behavior Research*, *8*(1), 286–296. https://doi.org/10.51847/nCoVT7740v

Handoyo, S. (2024). Evolving paradigms in accounting education: A bibliometric study on the impact of information technology. *The International Journal of Management Education*, *22*(3), 100998. https://doi.org/10.1016/j.ijme.2024.100998

Hangyál, Z., Schiller, E., & Dorner, H. (2026). A systematic literature review on Internationalisation at home from 2019–2024 – Intersections of initiatives and student skill development. *Innovations in Education and Teaching International*, 1–17. https://doi.org/10.1080/14703297.2026.2675342

HKICPA. (2019). *Professional Development Framework for PAIBs*. https://www.hkicpa.org.hk/-/media/Document/MS/Professional-Development-Framework-for-PAIBs/the-Framework.pdf

Hussin, S. N. A., Nik Wan, N. Z., Abdullah, A., Razak, S., San, S., Saidi, N., & Tumiran, S. D. (2023). Accounting students' knowledge and skills: Expectations of employers. *International Journal of Modern Education*, *5*(17), 210–219. https://doi.org/10.35631/IJMOE.517017

ICAEW. (2025). *Next Generation ICAEW CFAB Syllabus Handbook 2025–2026*. https://www.icaew.com/-/media/corporate/files/learning-and-development/next-generation-aca/icaew-cfab-syllabus-handbook.ashx

ICAI. (n.d.-a). *Syllabus Foundation Course*. Retrieved 11 September 2025, from https://resource.cdn.icai.org/74845bos60515-foundation.pdf

ICAI. (n.d.-b). *Syllabus Intermediate Course*. Retrieved 11 September 2025, from https://resource.cdn.icai.org/74847bos60515-intermediate.pdf

ICAI. (n.d.-c). *Syllabus—Information Technology Training & Soft Skills Course*. Retrieved 11 September 2025, from https://resource.cdn.icai.org/74846bos60515-itt.pdf

ICAS. (2024, April). *Behavioural Competencies Framework*. https://icas-com.uksouth01.umbraco.io/media/nvuntcwe/icas-behavioural-competencies-framework-202404.pdf#page=1.00

ICAS. (2025). *Guide to the ICAS syllabus 2025*. https://icas-com.uksouth01.umbraco.io/media/s4sak11b/ca-syllabus-2025-040225.pdf

IFAC. (2025a). *IES 2: Initial Professional Development – Technical Competence*. Education.Ifac.Org. https://education.ifac.org/part/ies-2

IFAC. (2025b). *IES 3: Initial Professional Development – Professional Skills*. Education.Ifac.Org. https://education.ifac.org/part/ies-3

IFAC. (2025c). *IES 4: Initial Professional Development – Professional Values, Ethics, And Attitudes*. Education.Ifac.Org. https://education.ifac.org/part/ies-4

Ikpeama, F. U., Nwaokokorom, O. W., & Paul-Mgbeafulike, V. S. (2025). Artificial intelligence skills required of accounting education students for job performance in the digital era. *Unizik Journal of Business Education and Entrepreneurship*, *1*(2), 75–82.

IMA. (2022). *IMA Management Accounting Competency Framework*. https://ldpconnect.com/wp-content/uploads/2023/02/IMA-Competency-Framework_2022.pdf

Imjai, N., Promma, W., Chanatup, S., Usman, B., & Aujirapongpan, S. (2025). Emerging roles of AI mindset, experiential learning and soft skills in developing career readiness for accountant 5.0 of Gen Z accounting students. *The International Journal of Management Education*, *23*(3), 101208. https://doi.org/10.1016/j.ijme.2025.101208

IPA. (n.d.). *Global Competency Framework*. Retrieved 4 July 2025, from https://www.publicaccountants.org.au/education/global-certificate-of-public-accounting-program/globalcompetencyframework

Jackling, B., & De Lange, P. (2009). Do accounting graduates' skills meet the expectations of employers? A matter of convergence or divergence. *Accounting Education*, *18*(4–5), 369–385. https://doi.org/10.1080/09639280902719341

Januszewski, A., Kujawski, J., Buchalska-Sugajska, N., & Śpiewak, J. (2024). Digital competencies of finance and accounting students. *Procedia Computer Science*, *246*, 4481–4491. https://doi.org/10.1016/j.procs.2024.09.298

Kee, H. Y. (2024). Incorporating digital skills in accounting education. In A. Perdana & T. Wang (Eds), *Digital Transformation in Accounting and Auditing: Navigating Technological Advances for the Future* (pp. 3–27). Springer International Publishing. https://doi.org/10.1007/978-3-031-46209-2_1

Koko, M., & Ajinwo, I. P. (2023). Generic skills acquisition and employability of accounting education graduates in Rivers State. *Global Scientific and Academic Research Journal of Education and Literature*, *1*(3), 16–22.

Koko, M., & Elekwachi, A. A. (2023). Accounting competencies required of accounting graduates in e-offices in Rivers State. *International Journal of Innovative Education Research*, *11*(2), 57–64.

Kotze, R., & Miller, T. (2023). Relational and decision-making skills development in South African accounting students. *Industry and Higher Education*, *37*(6), 762–781. https://doi.org/10.1177/09504222231162062

Le Boterf, G. (2010). *Ingénierie et évaluation des compétences* (6e éd). Eyrolles-Éd. d'Organisation.

Lima, H. C., & de Lima, G. A. S. F. (2025). Professional skills development in introductory accounting education: Insights from Brazil and International Educational Standards (IES). *Accounting Education*, *34*(5), 673–703. https://doi.org/10.1080/09639284.2025.2541183

Lkhagvasuren, K., Dorj, L., & Enkhee, U. (2023). Identifying discrepancies in perceptions of knowledge and skills between employers and educators in accounting education. *Journal of Accounting Theory and Practice*, *7*(1), 33–41.

Lleshaj, L., & Çika, N. (2023). Software skills and their impact on enhancing job performance: A perspective from finance and accounting postgraduate students. *Review of Economics and Finance*, *21*, 2485–2493. https://doi.org/10.55365/1923.x2023.21.264

Manira, S., & Effendy, L. (2024). The influence of technological knowledge and digital skills on accounting students' readiness to face artificial intelligence technology. *International Journal of Management, Accounting and Economics*, *11*(5), 581–598. https://doi.org/10.5281/ZENODO.11311900

Micallef, M., Mifsud, C., Ellul, L., Baldacchino, P. J., & Grima, S. (2023). The skill set required in the accounting workplace: Perspectives of accounting graduates and warrant holders. *International Journal of Economics and Business Administration*, *XI*(4), 117–145. https://doi.org/10.35808/ijeba/828

Moran, W. (2025). The essential AI skills and knowledge that business accounting students should acquire. *Journal of Management and Business Education*, *8*(2), 147–167. https://doi.org/10.35564/jmbe.2025.0009

Mulder, M. (2014). Conceptions of Professional Competence. In S. Billett, C. Harteis, & H. Gruber (Eds), *International Handbook of Research in Professional and Practice-based Learning* (pp. 107–137). Springer. https://doi.org/10.1007/978-94-017-8902-8_5

Muliati, Y., & Indriani, E. (2024). Analysis of competencies, soft skills, and digital literacy in the era of technological disruption (study on undergraduate accounting study program students FEB university of Mataram). *Asian Journal of Management, Entrepreneurship and Social Science*, *4*(2), 1418–1431.

Németh, E., Németh, K., & Szép, K. (2021). The development of competencies for employability digital competencies: Influence of the industry 4.0 concept to the digital competencies. *GILE Journal of Skills Development*, *1*(2), 68–81. https://doi.org/10.52398/gjsd.2021.v1.i2.pp68-81

Nesbit, T., Nishikawa, M., Robertson, J., & Gibson, J. (2023). The soft skills needed by accounting graduates: A New Zealand context. *The International Journal of Learning in Higher Education*, *31*(1), 51–68. https://doi.org/10.18848/2327-7955/CGP/v31i01/51-68

Nie, Y., & Mastor, N. H. (2024). Accounting employability: A systematic review of skills, challenges, and initiatives. *Cogent Business & Management*, *11*(1), 2433161. https://doi.org/10.1080/23311975.2024.2433161

Nwalado, S. H., Onyemah, L. N., & Oru, P. O. (2024). Assessment of financial management skills required of accounting students in tertiary institutions in Delta State for effective operation of small scale business. *African Education Indices*, *13*(1). https://acjol.org/index.php/indices/article/view/4963

Nwaogazie, A., Obayi, A. U., & Ede, M. O. (2024). Assessment of marketing and accounting skill needs of economics education graduates for managing small-scale businesses in Southeast, Nigeria. *International Journal of Economics Education Research (IJEER)*, *7*(2), 19–30.

OECD. (2019). Paysage économique de l'IA. In OECD, *L'intelligence artificielle dans la société* (OCDE). OECD. https://doi.org/10.1787/eba1ae69-fr

Ordu, P., & Adama, T. A. (2025). Digital skills required of business education accounting students for employability in Niger Delta University, Bayelsa State. *FUO-Journal of Educational Research*, *4*(1), 158–166. https://doi.org/10.5281/zenodo.14873209

Puriboriboon, P. (2025). Employers' expectations for accounting graduates in an era of disruptive innovation. *Human Behavior, Development and Society*, *26*(1), 103–116. https://doi.org/10.62370/hbds.v26i1.278533

Razali, F. A., Jusoh, M. A., Abu Talib, S. L., & Awang, N. (2022). The Impact of Industry 4.0 Towards Accounting Profession and Graduate's Career Readiness: A Review of Literature. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, *7*(7), e001624. https://doi.org/10.47405/mjssh.v7i7.1624

Rhodes, N. (2023). Identifying the future skills requirements to better prepare accounting graduates. *The Future of Education 13th Edition*. https://conference.pixel-online.net/files/foe/ed0013/FP/5819-ICT6026-FP-FOE13.pdf

Rkein, H. I., Hejase, H. J., Rkein, A., Hamdar, B., & Shehadeh, M. (2024). Future graduate competencies: Perception of Lebanese accounting graduates, academics, and employers. *Asian Business Research*, *9*(2), 1–30. https://doi.org/10.20849/abr.v9i2.1459

Rosi, N. M. K., & Mahyuni, L. P. (2021). The future of accounting profession in the industrial revolution 4.0: Meta-synthesis analysis. *E-Jurnal Akuntansi*, *31*(4), 1010–1024. https://doi.org/10.24843/EJA.2021.v31.i04.p17

SAICA. (2022). *The CA2025 professional values, attitudes and acumens in practice*. https://saicawebprstorage.blob.core.windows.net/uploads/resources/3-The-CA2025-Professional-Values-Attitudes-and-Acumens-in-Practice.pdf

SAICA. (2023). *CA(SA) competency framework "CA of the Future": Guidance on the content, development and assessment of competencies in the academic programme*. https://saicawebprstorage.blob.core.windows.net/uploads/resources/CA-of-the-Future-Competency-Framework-applicable-to-IAC-January-2025.pdf

SkillsFuture Singapore, Workforce Singapore, Singapore Accountancy Commission, & ISCA. (2020). *Skills Framework for Accountancy. A guide to occupations and skills*.

Soproni, Z. (2023). Employability skills: Rethink your learning. *GILE Journal of Skills Development*, *3*(2), 53–65. https://doi.org/10.52398/gjsd.2023.v3.i2.pp53-65

Stancheva-Todorova, E. (2020). The knowledge and skills profile of accountant 4.0. *Horizons - International Scientific Journal*, *25*(2), 79–95. https://doi.org/10.20544/HORIZONS.A.25.2.20.P05

Taib, A., Awang, Y., Mohamed Shuhidan, S., Zainal Zakaria, Z. N., Sulistyowati, S., & Ifada, L. M. (2023). Digitalization of the accounting profession: An assessment of digital competencies in a Malaysian comprehensive university. *Asian Journal of University Education*, *19*(2), 365–380. https://doi.org/10.24191/ajue.v19i2.22229

Thi, N. N., & Ngoc, T. T. (2024). Employers' expectations and learners' perceptions of skills and knowledge of accounting-auditing graduates in Vietnam. *Conhecimento & Diversidade*, *16*(41), 47–62. https://doi.org/10.18316/rcd.v16i41.11468

Tiron-Tudor, A., Labaditis (Cordos), A., & Deliu, D. (2025). Future-ready digital skills in the AI era: Bridging market demands and student expectations in the accounting profession. *Technological Forecasting and Social Change*, *215*, 124105. https://doi.org/10.1016/j.techfore.2025.124105

Twyford, E., & Dean, B. A. (2024). Inviting students to talk the talk: Developing employability skills in accounting education through industry-led experiences. *Accounting Education*, *33*(3), 296–318. https://doi.org/10.1080/09639284.2023.2191288

Ugwunwoti, E. P., Onah, G. N., Ngene, J. T., & Anyanwuocha, C. T. (2025). Soft skills needed by accounting education students in universities for effective performance after graduation in Enugu State. *Innovative Journal of Entrepreneurship and Business (IJEB)*, *13*(1), 13–23. https://doi.org/10.5281/zenodo.14673031

van den Berg, E., & Rothmann, S. (2024). Twenty-first-century competencies and capabilities for financial accounting students. *South African Journal of Economic and Management Sciences*, *27*(1), a5535. https://doi.org/10.4102/sajems.v27i1.5535

World Economic Forum. (2023). *The future of jobs report 2023*. https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf

World Economic Forum. (2025). *Future of jobs report 2025*. https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf

Yunos, R. M., Hashim, F., Ahmad, S. A., & Mohd Taha, F. N. (2023). Assessing the perceived skills of tertiary accounting students by employers. *Insight Journal*, *10*(2), 140–148. https://doi.org/10.24191/ij.v10i2.4483

Zarifian, P. (2001). *Le modèle de la compétence. Trajectoire historique, enjeux actuels et propositions*. Editions Liaisons.

Zhang, S., Sun, S., & Leung, M. K. (2025). Digital skills for the accounting and finance profession: Evidence from online job advertisements in Hong Kong and Singapore. *Cogent Education*, *12*(1), Article 2532917. https://doi.org/10.1080/2331186X.2025.2532917

Declaration Statements

Conflict of Interest

The authors report no conflict of interest.

Funding

The authors received no financial support for this article's research, authorship, and/or publication.

Data Availability
The source-by-competency coding matrix is provided as Supplementary Material. Additional screening records are available from the corresponding author upon reasonable request.

AI Use
OpenAI ChatGPT was used for language editing, concision, and restructuring of the manuscript, and for technical assistance in generating the heatmaps used to visualise the results. The literature search, study selection, development of the analytical framework, coding of the sources, frequency calculations, interpretation of the findings, and all final methodological and editorial decisions remained the responsibility of the authors. ChatGPT did not create or modify the underlying dataset. All AI-assisted outputs were reviewed and, where appropriate, revised by the authors, who take full responsibility for the content and integrity of the manuscript. The authors further affirm that all cited sources are real, accurately referenced, and have been verified by the authors.

Ethics Statement
This study is based exclusively on published academic literature and publicly available professional sources and did not involve human participants or personal data. Ethical approval was therefore not required. The authors confirm that the study adhered to applicable ethical guidelines.

Open Access Agreement
This article is published under a CC BY 4.0 license. This license allows reusers to distribute, remix, adapt, and build upon the material in any medium or format, so long as attribution is given to the creator. The license allows for commercial use.

Corresponding Author
The corresponding author for this manuscript is Vanissla Hutzli who can be contacted by email via vanissla.hutzli@hesge.ch.