International Journal of Technology and Applied Science (IJTAS)
E-ISSN: 2230-9004 ● Website: www.ijtas.com ● Email: editor@ijtas.com

The Digital Skills Gap for Technology Solutions for Computer Science Education

Shelke Bharat Abhimanyu

Associate Professor
Shri Chhatrapati Shivaji College, Omerga, Dist. Dharashiv, Maharashtra.

Abstract:
This study explores the persistent digital skills gap in computer science education and examines technology-based solutions to address it through a qualitative secondary research approach. Drawing on peer-reviewed literature, policy reports, and institutional data, the research identifies key themes: extent of the gap, curriculum alignment, system readiness, equity barriers, employer expectations, and effectiveness of interventions. Thematic analysis reveals deficiencies in advanced competencies, inequitable access, and weak curriculum-industry alignment. Technology solutions, though promising, require systemic integration, educator training, and equity-conscious implementation. The findings provide evidence-based insights for aligning computer science education with global workforce needs.

Keywords: Digital skills gap; Computer science education; Technology solutions; Curriculum alignment; Workforce readiness.

Chapter 1: Introduction

1.1 Research Background

In the era of rapid digitalisation, computer science education has become pivotal for preparing students for the 21st-century workforce. However, a growing body of evidence suggests a significant digital skills gap among students and graduates, undermining this goal. For example, a study surveying 432 U.S. college students in 2023 found only **52%** self-identified as "highly proficient" in digital skills, while **45%** considered themselves "somewhat proficient" and **3%** "deficient," despite their exposure to digital environments (Mentzer et al., 2024).

Globally, the RAND Corporation reported that demand for digital skills far outpaces supply, and that COVID-19 worsened inequalities in digital access and learning opportunities, especially in countries with weaker infrastructure (Feijao et al., 2021). In higher education settings in France, a study of 1,323 students found that investment in ICT and digital skills was positively correlated with academic performance; however, training programs are often insufficient and lag behind students' needs (Ben Youssef et al., 2022).

Further, among university students internationally, gaps in "advanced digital skills" (e.g. complex software, data tools) were measured between **8%** and **54%**, with many areas exceeding a **30%** deficit in such skills relative to what employers expect (Romi, 2024). These findings suggest that while many learners possess basic digital capability, the gap widens sharply at more advanced levels, particularly in computer science curricula.

1.2 Research Rationale

The digital skills gap poses serious risks to both individual employability and broader economic competitiveness. Over **92%** of all jobs now require at least some digital skills, yet about **one-third** of workers lack even foundational digital capabilities, limiting access to these positions (National Skills Coalition & Federal Reserve Bank of Atlanta, 2023) (Bogue, 2023). Employers echo this concern: **56%** report difficulty finding candidates with required digital skills, especially in technology-driven roles (Linder, 2025). In England and Scotland, 49% of employers say they are struggling to recruit workers with needed digital skills, despite estimated costs of £63 billion associated with unfilled roles due to this gap (Learning and Work Institute, 2024). Addressing this gap is vital to ensure that computer science education aligns with industry demands and equips learners with relevant, marketable skills.

1.3 Aims and Objectives

Aim

The aim is to investigate technology-based solutions for bridging the digital skills gap in computer science education effectively.

Objectives

- To examine the extent of the digital skills gap in computer science education.
- To identify the challenges educators and students face in adopting technology-based solutions.
- To explore the effectiveness of existing digital tools and resources in bridging the skills gap.
- To propose strategies for integrating technology solutions to reduce the digital skills gap.

1.4 Research Question

- What is the current extent of the digital skills gap in computer science education?
- What challenges do educators and students face when adopting technology solutions in computer science education?
- How effective are existing digital tools and resources in addressing the digital skills gap?
- What strategies can be proposed to integrate technology solutions for reducing the digital skills gap?

1.5 Research Problem

Despite over **92%** of jobs globally requiring digital skills, approximately one-third of workers lack foundational digital competencies, limiting their employability (National Skills Coalition/Fed Reserve Atlanta, 2023) (Bogue, 2023). Meanwhile, **56%** of employers report difficulty finding candidates with adequate digital skills, particularly in technology and computer science roles (Linder, 2025). These gaps hinder technology-based solutions in education from fully addressing the demands of the workforce.

1.6 Research Significance

Bridging the digital skills gap is vital for economic growth. Projections show that 14 G20 states could miss out on **a cumulative GDP of US$11.5 trillion** by 2030 if gaps in digital capabilities persist (RAND/Salesforce) (Hundrev, 2024). In addition, tech talent shortages are forecast to cost organisations **US $5.5 trillion** by 2026, particularly in areas like cloud architecture, software development, and data management (IDC) (Ashare, 2024). In educational settings, over **90%** of jobs now require digital skills, yet roughly **one-third** of the workforce lacks even basic digital proficiency, highlighting misalignment between education outcomes and job demands (National Skills Coalition / Fed Reserve Atlanta) (National Skills Coalition, 2023). Thus, research on how technology-based solutions in computer science education can reduce this skills gap can inform policy, guide curriculum design, and improve workforce readiness globally.

1.7 Chapter Summary

This chapter introduced the global digital skills gap in computer science education, highlighting its scale, causes, and economic implications. It outlined the research rationale, aim, objectives, and questions, emphasising the urgency of aligning education with workforce needs. The chapter concludes that technology-based solutions are essential to bridging this critical gap.

Chapter 2: Literature Review

2.1 Introduction

The rapid digital transformation has positioned computer science education as a cornerstone for future workforce readiness. However, persistent gaps in digital skills hinder learners from meeting industry expectations. Addressing these disparities through technology-based solutions is critical to ensure equitable access, curriculum alignment, and global competitiveness in a knowledge-driven economy.

2.2 General Overview

2.2.1) Scope and measurement of the digital skills gap

Recent international monitoring underscores that core and advanced digital competencies remain unevenly developed across learners and educators. As per the European Commission's (2022) DESI, **only 54%** of individuals demonstrate *at least* basic digital skills, far below the **80%** target for 2030, with wide disparities across contexts. Beyond foundational abilities, labour-market surveys anticipate **23% job churn** by 2027 and report that **44% of workers' skills will be disrupted**, signalling intensifying demand for higher-order capabilities such as data analysis, AI literacy and systems thinking (World Economic Forum, 2023). OECD's *Skills Outlook 2023* likewise projects growing demand for interacting with computers, analysing data and creative problem-solving, while noting that **18% of adults** in OECD countries do not reach baseline proficiency in key information-processing domains—impeding resilience in the green-digital transition (OECD, 2023).

2.2.2) Curriculum frameworks and competency definitions

Clear, widely adopted competency models are crucial for aligning computer science education with market needs. The **ACM/IEEE Computing Curricula 2020 (CC2020)** provides outcome-based, globally oriented guidance for computing programs, calling for competency- and disposition-focused curricula that integrate ethics and lifelong learning with technical mastery (ACM/IEEE, 2020). Complementing this, the **DigComp 2.2** framework specifies five competence areas and **250+** knowledge/skill/attitude examples (e.g., data literacy, safety, problem solving, and AI-related awareness), offering granular proficiency levels that institutions can embed into modules, assessments and credentialing (European Commission, 2022). Together, CC2020 and DigComp 2.2 furnish a shared language linking basic, intermediate and advanced digital competencies with program outcomes in computer science and adjacent fields.

2.2.3) System capacity, teaching readiness, and edtech governance

The **OECD Digital Education Outlook 2023** finds that while many systems adopted LMSs and student-information platforms during the pandemic, true *transformation* lags due to interoperability gaps, uneven connectivity and limited teacher confidence. Notably, ~**60%** of teachers received digital education training in the past year, yet **~20%** still report needing further training; PISA data also show performance benefits at moderate device use but risks from distraction and overuse (Organisation for Economic Co-operation and Development, 2023). These findings suggest that simply expanding devices or platforms is insufficient; capacity-building for educators (e.g., DigCompEdu-aligned training) and coherent governance of data, AI and procurement are prerequisites for effective technology-enhanced CS curricula.

2.2.4) Equity, access, and the uneven reach of technology

Evidence indicates that technology-enabled learning expands opportunity yet can magnify inequality without inclusive design. **UNESCO's 2023 GEM Report** estimates that distance learning during COVID-19 had the potential to reach **over 1 billion** learners but still **failed to reach at least 500 million (31%)**, and that only **40% of primary**, **50% of lower-secondary**, and **65% of upper-secondary** schools are internet-connected globally (UNESCO, 2023). **UNICEF** similarly reports that during school closures, **over two-thirds of children** could not access online learning due to connectivity, device and affordability barriers, underscoring the need to pair digital pedagogy with infrastructure and affordability solutions (UNICEF, 2021). For computer science education, this implies that interventions (e.g., cloud IDEs, data science labs, AI sandboxes) must be equity-conscious—optimised for low bandwidth, offline options, and accessible design—to avoid reproducing skill stratification.

2.2.5) Labour-market signals and employer expectations

Employer surveys point to accelerating adoption of big data, cloud and AI (**~75%** of firms plan adoption within five years) and to strategic emphasis on **technology literacy**, **AI & big data**, and **analytical/creative thinking** (World Economic Forum, 2023). A 2025 study by Wiley, titled "*Are Graduates Digitally Unprepared?...*", surveyed both graduates and employers to identify perception gaps. While many graduates rated themselves as proficient in collaboration tools, adaptability, and technical IT skills, employers reported significant dissatisfaction in precisely these areas. Employers particularly criticised weaknesses in "soft digital skills" such as remote teamwork, adaptability to new systems, and critical evaluation of digital information (Zhou et al., 2025). From a system perspective, DESI indicators also track **ICT specialists (4.5% of EU employment)** and **female ICT specialists (19%)**, signalling persistent pipeline and diversity issues that curricula must address early through inclusive pathways and targeted support (European Commission, 2022).

2.2.6) Program design: scaffolding from basic to advanced skills

The World Bank's **Digital Skills Frameworks and Programs** integrates DigComp (citizens) with the **e-Competence Framework** (ICT professions), proposing staged provision: universal **basic** skills in compulsory schooling, **intermediate** skills for all undergraduates, and **advanced** skills in upper-secondary TVET and higher education—paired with robust assessment indicators (World Bank, 2020). Such scaffolding is directly applicable to computer science, where foundational digital capability (information/data literacy, safety, collaboration) should be prerequisites to advanced competencies (algorithms, software engineering, data systems, cybersecurity and AI ethics). Mapping program outcomes to DigComp 2.2 levels and CC2020 domains enables constructive alignment of learning activities, authentic assessments (e.g., portfolio artefacts, code reviews, dataset audits), and stackable credentials recognised by employers (ACM/IEEE, 2020)

2.2.7) Technology solutions and evidence standards

Edtech selection must be evidence-led and pedagogically integrated. The **UNESCO GEM 2023** notes that many products change on ~**36-month cycles** and that rigorous evidence is scarce; over-emphasis on devices without instructional integration (e.g., Peru's laptop initiative) did **not** improve learning, whereas structured digital content and blended supports can yield sizeable gains (UNESCO, 2023). The **OECD Digital Education Outlook** adds that interoperability and trustworthy data governance are critical for scaling adaptive assessment, analytics and AI-supported tutoring, while teacher professional learning remains the linchpin for sustained impact (Organisation for Economic Co-operation and Development, 2023). As per Papagiannis & Pallaris (2024), technology solutions for CS education should prioritise open standards, privacy-by-design, and alignment with competency frameworks, complemented by iterative evaluation.

2.2.8) Synthesis for computer science education

Taken together, the literature indicates that the digital skills gap is simultaneously a measurement challenge (comparable indicators), a curricular challenge (alignment with competencies and labour-market signals), and an implementation challenge (equity, governance, and educator capacity). Evidence from DESI, WEF and OECD quantifies both the shortfall and the direction of skill demand; UNESCO and UNICEF highlight access constraints; CC2020 and DigComp 2.2 offer blueprints for curricular and assessment alignment; and the World Bank provides scalable program architectures. A strategic pathway for computer science education is thus to **embed DigComp-aligned foundational skills early**, **integrate CC2020 competencies through project-based modules**, **credential intermediate/advanced skills** via authentic assessments, and **govern adoption** with interoperability and evidence standards—thereby narrowing the global digital skills gap in ways that are equitable, market-relevant and pedagogically sound.

2.3 Literature Gap

While extensive research has explored the digital skills gap, several limitations persist. European Commission (2022) and OECD (2023) quantify deficiencies in basic and advanced digital skills, yet few studies employ validated, discipline-specific measures for computer science. Romi (2024) and Zhou et al. (2025) reveal significant misalignments between graduate competencies and employer expectations, but evidence often relies on self-perceptions. Papagiannis and Pallaris (2024) demonstrate the potential of makerspaces, though longitudinal evaluations of technology solutions such as AI tutors, cloud IDEs, and single-board computers remain limited. Furthermore, UNESCO (2023) and UNICEF (2021) highlight equity challenges, yet integration with CC2020 and DigComp 2.2 frameworks is underexplored.

Chapter 3: Methodology

3.1 Research Paradigm (Philosophy, Approach & Strategy)

This study adopts an interpretivist philosophy, recognising that the digital skills gap is socially constructed and context-dependent, requiring a nuanced understanding rather than generalisation (Snyder, 2019). A qualitative approach is employed, enabling critical interpretation of existing scholarly evidence to uncover themes, patterns, and meanings within the literature (Kirongo & Odoyo, 2020). The study design relies on a systemic reviewing of secondary literature, synthesis of peer-reviewed studies, institutional researchers and policy documents released during 2019-2025. This research design will offer broad coverage, intensive comparison and thematic organizing results to deliberate on the effectiveness of technology solutions to bridge the digital gap during Computer science teaching.

3.2 Data Collection

It relies exclusively on **secondary sources** of data collection, including peer-reviewed journals, academic books, institutional reports, and policy documents. It becomes a systematic search of possible, useful, and basic materials with identification of the evidence that could be positioned with the necessity and is accessible and credible. The approach promotes a critical and holistic synthesis, which is consistent with the objectives of the research (Pandey & Pandey, 2021).

3.3 Qualitative Data Analysis

The **thematic analysis** is used to review the literature acquired and introduce the possibility of recognizing recurrent patterns, concepts, and themes. The comparison and synthesis are materially analysed to determine correlations among technology closeness gaps, difficulties, and interventions (Mishra & Alok, 2022). This provides a systematized meaning wherein additional information will be generated in accordance to the research purpose of the study.

3.4 Ethical Consideration

It will also involve **secondary data** only, and no direct involvement of any human will be pertinent to the study. All sources are duly acknowledged appropriately with citation and reference to ensure integrity in academia (Arifin, 2018). It includes only credible and authentic materials, shunning plagiarism and misrepresentation, and maintains transparency, reliability, and ethical proceedings of the research at all stages of the study.

Chapter 4: Data Analysis and Discussion

4.1 Introduction

The study employed a thematic qualitative design, which was suitable for conducting secondary research and systematically identifying, comparing, and interpreting common findings and evidence related to the digital skills gap and technology solutions. This approach aligned the analysis with the research aims and purpose, as well as significant emerging themes.

4.2 Analysis of the Data

Extent and Measurement of the Digital Skills Gap

This data demonstrated a significant indication of a digital skills gap, especially in high-order competencies. According to reports, such as the European Commission's DESI (2022) or the OECD's Skills Outlook (2023), basic digital skills are being developed moderately, indicating that only a small portion of learners will have more advanced abilities, including data analysis, AI literacy, and problem-solving.

Curriculum Frameworks and Competency Alignment

It seemed to be a common thread running through the data that internationally recognised competency frameworks are significant. The ACM/IEEE CC2020 (2020) and DigComp 2.2 (European Commission, 2022) were the reference points to structure and define, categorise, and measure digital competencies in a systematic way. It was demonstrated that these frameworks do provide concise directions; however, their inclusion in the curricula is not evenly spread out with vast disparities in the scope of teaching and assessing digital skills.

System Readiness and Pedagogical Capacity

Findings across OECD (2023), de Guzman (2022), and other sources emphasised system-level challenges such as teacher readiness, institutional infrastructure, and governance structures. The data indicated that while many institutions adopted digital platforms during the pandemic, meaningful pedagogical transformation was limited by inadequate training and lack of confidence among educators. This theme reinforces the argument that technology alone is insufficient without systemic capacity-building.

Equity and Access Constraints

A critical theme across UNESCO (2023) and UNICEF (2021) reports was the uneven distribution of digital opportunities. The analysis showed that socio-economic barriers, connectivity issues, and affordability constraints disproportionately affected learners in low-income and rural contexts. The literature indicated that interventions not designed with inclusivity in mind risk exacerbating the skills gap.

Employer Expectations and Workforce Alignment

Employer surveys, such as those reported by the World Economic Forum (2023) and Zhou et al. (2025), consistently showed dissatisfaction with graduate preparedness. The analysis revealed a misalignment between employer expectations—especially for advanced and soft digital skills—and the competencies delivered in computer science education. This theme demonstrates the urgency of curriculum reform.

Technology Solutions and Effectiveness

Finally, the analysis of interventions, including makerspaces (Papagiannis & Pallaris, 2024) and single-board computers (Álvarez Ariza & Baez, 2022), showed that experiential learning models hold strong potential for reducing the digital skills gap. However, the evidence base remains fragmented, with limited longitudinal or comparative evaluations.

4.3 Discussions

The findings underscore that the **digital skills gap** is not merely a technical shortfall but a socio-educational phenomenon consistent with **sociocultural theory**, which situates learning within social systems and mediated tools. The gap emerges where access, infrastructure, and institutional readiness act as mediating conditions that shape how learners internalise digital practices. Empirical evidence supports this: in the UK, the digital skills gap is estimated to cost the economy **£63 billion annually**, and about **18% of adults** lack essential workplace digital competencies (UK Government, 2024).

Curriculum frameworks such as **CC2020** and **DigComp 2.2** theoretically offer scaffolding across levels, but data show inconsistent adoption in CS curricula: advanced digital skills continue to face shortages (OECD, 2023). The **Technology Acceptance Model (TAM)** also helps explain resistance: system capacity—teacher confidence, platform usability, and institutional support strongly influence perceived usefulness and adoption (Ahmad et al., 2023). The literature reports that roughly **60% of teachers** have digital training, but **20% still require further upskilling** (OECD, 2023), indicating that capacity gaps persist.

Moreover, the **equity lens** from **critical theory** reveals that digital interventions can replicate inequality if not designed inclusively. UNESCO (2023) finds that only 40% of primary, 50% of lower-secondary, and 65% of upper-secondary schools globally have reliable internet connectivity. This gap disproportionately affects marginalised students. For instance, a makerspace intervention in CS education showed statistically significant gains in 21st-century skills (Papagiannis & Pallaris, 2024), yet its scalability in low-resource settings remains untested.

Last but not least, employer surveys reveal a disconnect: even though graduates report high competence, stakeholders mention shortages of "soft digital skills" and flexibility (Zhou et al., 2025). This equilibrium underscores the relevancy of constructive alignment theory which requires alignment of curricula in a manner that is direct as dictated by their (employer) expectations and assessment in order to establish relevance.

4.4 Summary

These themes are combined in one way of a persevering image of the digital strengths gap in the form of evaluations and the rough side. The study demonstrates that to bridge the divide, we must have competency framework, system-level preparation, equity, an acceptable education-employer suit, and a severe evaluation of new technological products and services. All of these components together, capacity-driven system, levelled scaffolds, equal chance to talent, and academic productivity, are requested in model of the labour market, which overall are needed to close the digital divide.

Chapter 5: Conclusion and Recommendation

5.1 Conclusion

In the context of the results of this research, one of the primary limitations to workforce preparedness and competitive activity in the international scene can be identified as the absence of digital skills in the curriculum on computer sciences. It is shown that there is a mismatch between the course and company demand, unequal access to resources, and lack of higher skill development. In the absence of systematic exploitation of the undesired aspects of these alternatives, the possible of technological and solutions such as makerspaces, cloud IDEs, and AI instructors are yet to be implemented. The gap needs to be bridged with theory-oriented, evidence-based solutions, involving integration and enhancement of competency frameworks, interlinkage between education and labour markets.

5.2 Recommendation

- Implement Digital Competencies standards frameworks of CC2020 and DigComp 2.2 in curricula.
- Enhance teacher training and professional development to foster confidence in digital pedagogy.
- Emphasise equity-based interventions such as low-bandwidth, offline and publicly accessible technology.
- Establish an industry-academic relationship to align skills training with industry demands.
- Foster practical learning (e.g. makerspaces, SBCs, AI tutors) to be practically digitally competent.
- Implement intensive surveillance and longitudinal evaluation of digital skills programs.
- Support policy changes embracing inclusive infrastructure and digital governance.

REFERENCES:

1. ACM/IEEE. (2020). *A Computing Curricula Series Report Computing Curricula 2020 CC2020 Paradigms for Global Computing Education encompassing undergraduate programs in*. https://www.acm.org/binaries/content/assets/education/curricula-recommendations/cc2020.pdf
2. Ahmad, S., Mohd Noor, A. S., Alwan, A. A., Gulzar, Y., Khan, W. Z., & Reegu, F. A. (2023). eLearning acceptance and adoption challenges in higher education. *Sustainability*, *15*(7), 6190.https://www.mdpi.com/2071-1050/15/7/6190
3. Arifin, S. R. M. (2018). Ethical considerations in qualitative study. *International Journal of Care Scholars*, *1*(2), 30–33. https://journals.iium.edu.my/ijcs/index.php/ijcs/article/download/82/27
4. Ashare, M. (2024, May 17). *What's the cost of the IT skills gap? IDC says $5.5 trillion by 2026*. CIO Dive. https://www.ciodive.com/news/tech-talent-skills-gaps-cost-trillions-idc/716523
5. Ben Youssef, A., Dahmani, M., & Ragni, L. (2022). ICT use, digital skills and students' academic performance: Exploring the digital divide. *Information*, *13*(3), 129. https://doi.org/10.3390/info13030129
6. Bogue, E. (2023). *Baseline for Work: 92 Percent of Jobs Require Digital Skills*. Www.atlantafed.org. https://www.atlantafed.org/community-development/publications/partners-update/2023/08/10/baseline-for-work-92-percent-of-jobs-require-digital-skills
7. European Commission. (2022). *Digital Economy and Society Index (DESI) 2022* . https://www.coit.es/sites/default/files/ce_desi_full_european_analysis_2022.pdf

8. Feijao, C., Flanagan, I., Van Stolk, C., & Gunashekar, S. (2021, December 15). *The global digital skills gap: Current trends and future directions*. Www.rand.org. https://www.rand.org/pubs/research_reports/RRA1533-1.html
9. Hundrev, I. (2024). *Need-to-know skills gap statistics | InStride*. Instride.com. https://www.instride.com/insights/skills-gap-statistics
10. Kirongo, A., & Odoyo, C. (2020). Research philosophy design and methodologies: A systematic review of research paradigms in information technology. http://repository.must.ac.ke/bitstream/handle/123456789/329/Impact_of_Drought_on_the_Spatial_Pattern.pdf?sequence=1
11. Learning and Work Institute. (2024, November 28). *New report highlights a need to look beyond graduates to close digital skills gaps - Learning and Work Institute*. Learning and Work Institute. https://learningandwork.org.uk/news-and-policy/new-report-highlights-a-need-to-look-beyond-graduates-to-close-digital-skills-gaps
12. Linder, J. (2025). *Skills Gap Statistics Statistics: Market Data Report 2025*. Gitnux.org. https://gitnux.org/skills-gap-statistics
13. Mentzer, K., Frydenberg, M., & Patterson, A. (2024). Are Tech Savvy Students Tech Literate? Digital and Data Literacy Skills of First-Year College Students. *Information Systems Education Journal*, *22*(3), 4–24. https://doi.org/10.62273/mfsd3135
14. Mishra, S. B., & Alok, S. (2022). *Handbook of research methodology*. https://www.nkrgacw.org/nkr%20econtent/nutrition%20and%20dietetics/PG/II.M.Sc%20N&D/BookResearchMethodology.pdf
15. National Skills Coalition. (2023). *New Report: 92% of Jobs Require Digital Skills, One-Third of Workers Have Low or No Digital Skills Due to Historic Underinvestment, Structural Inequities*. National Skills Coalition. https://nationalskillscoalition.org/news/press-releases/new-report-92-of-jobs-require-digital-skills-one-third-of-workers-have-low-or-no-digital-skills-due-to-historic-underinvestment-structural-inequities
16. OECD. (2023). *OECD Skills Outlook 2023*. OECD. https://www.oecd.org/en/publications/oecd-skills-outlook-2023_27452f29-en.html
17. Organisation for Economic Co-operation and Development. (2023). *OECD Digital Education Outlook 2023*. OECD. https://www.oecd.org/en/publications/oecd-digital-education-outlook-2023_c74f03de-en/full-report.html
18. Pandey, P., & Pandey, M. M. (2021). *Research methodology tools and techniques*. Bridge Center. http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4666/1/RESEARCH%20METHODOLOGY%20TOOLS%20AND%20TECHNIQUES.pdf
19. Papagiannis, P., & Pallaris, G. (2024). *Evaluating 21st Century Skills Development through Makerspace Workshops in Computer Science Education*. ArXiv.org. https://arxiv.org/abs/2411.05012
20. Romi, I. M. (2024). Analysing University Students' Digital Skills Gap and Its Implications for SDGS: an Empirical Investigation. *Journal of Lifestyle and SDGs Review*, *4*(3), e02189–e02189. https://doi.org/10.47172/2965-730x.sdgsreview.v4.n03.pe02189
21. Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://www.sciencedirect.com/science/article/pii/S0148296319304564
22. UK Government. (2024). *Digital skills and careers* . https://researchbriefings.files.parliament.uk/documents/CDP-2024-0073/CDP-2024-0073.pdf
23. UNESCO. (2023). *2023 Global Education Monitoring Report*. 2023 GEM Report. https://gem-report-2023.unesco.org

24. UNICEF. (2021). *DIGITAL LEARNING FOR EVERY CHILD: CLOSING THE GAPS FOR AN INCLUSIVE AND PROSPEROUS FUTURE*. https://www.unicef.org/media/113896/file/Digital%20Learning%20for%20Every%20Child.pdf
25. World Bank. (2020). *Digital Skills: Frameworks and Programs Public Disclosure Authorized Public Disclosure Authorized Public Disclosure Authorized Public Disclosure Authorized*. https://documents1.worldbank.org/curated/en/562351611824219616/pdf/Digital-Skills-Frameworks-and-Programs.pdf
26. World Economic Forum. (2023, April 30). *The Future of Jobs Report 2023*. World Economic Forum. https://www.weforum.org/publications/the-future-of-jobs-report-2023/
27. 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). https://doi.org/10.1111/jcal.70046