

## RESEARCH ARTICLE

# INVESTIGATING THE RELATIONSHIP BETWEEN DIGITAL LITERACY AND ACADEMIC PERFORMANCE AMONG UNDERGRADUATE STUDENTS ENROLLED IN THE TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING PROGRAMME

Marlina Mohamad<sup>1</sup>, Asiah Mohamad<sup>2\*</sup>, Abdul Jalil Omar<sup>3</sup>

<sup>1</sup>Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, 86400 Johor, Malaysia

<sup>2</sup>Centre of Foundation Studies, Universiti Teknologi MARA, Selangor Branch, Dengkil Campus, 43800 Selangor, Malaysia

<sup>3</sup>Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, 86400 Johor, Malaysia

**ABSTRACT** - This study aims to investigate the relationship between digital skills and academic performance among undergraduate students in the Technical and Vocational Education and Training (TVET) programme. The study employs a survey research design and includes a sample of undergraduate students in the TVET programme from a selected university in Malaysia. This study uses a survey questionnaire to collect data on digital literacy, and academic performance from the student database. Findings reveal a weak-to-moderate positive correlation between digital literacy and academic performance, suggesting that digital competency may enhance academic success but is not the sole determinant. The results suggest that students with higher digital literacy tend to have better academic performance in their previous exams than those with lower digital literacy. The study also explores the implications of the findings for education and makes recommendations on how universities can improve digital literacy among their students to enhance their academic performance. Overall, this study makes a valuable contribution to our understanding of the relationship between digital literacy and academic performance among undergraduate students in the TVET programme. The findings have important implications for policy and practice in education, offering guidance for future research in this area.

## ARTICLE HISTORY

Received : 28<sup>th</sup> Feb. 2025

Revised : 16<sup>th</sup> Mar. 2025

Accepted : 21<sup>st</sup> Apr. 2025

Published : 30<sup>th</sup> June 2025

## KEYWORDS

*Digital literacy*

*TVET*

*Academic performance*

## INTRODUCTION

Students now connect with knowledge in a different way, thanks to the digital revolution. Students today gather, analyse, and spread information in ways that were unthinkable even a few decades ago. Digital literacy is now crucial for students at educational institutions as a result of this development. Being able to use digital technologies is only one aspect of digital literacy. Additionally, it involves using digital technology responsibly to create, assess, and distribute information. All sectors have been significantly impacted by this transition, including education, where digital literacy has become an essential skill for students (Allister, 2016). According to Allister (2016), the concept of digital literacy goes beyond simply knowing how to use digital tools. It comprises the ability to analyse, invent and communicate information using digital technology.

The Technical and Vocational Education and Training (TVET) programme, aimed at providing students with practical skills relevant to specific jobs or vocations, has not been immune to this digital shift. The integration of digital literacy skills into the TVET curriculum is increasingly viewed as essential in preparing students for a rapidly evolving workforce (Choy, Wärvik & Lindberg, 2018). Understanding the role of digital literacy in academic performance can help educators prepare students for the digital demands of their future careers, particularly in technical and vocational fields where digital tools are often integral to the work (Nikou & Aavakare, 2021, Yeşilyurt & Vezne, 2023). The relationship between digital literacy and academic performance has been a topic of interest in educational research. However, the findings have been inconsistent, with some studies suggesting a positive correlation, (Helsper & Eynon, 2010; van Laar, van Deursen, van Dijk, & de Haan, 2017), while others find no significant relationship. For instance, Helsper and Eynon (2010) found that digital literacy, defined as the ability to access, manage, integrate, evaluate, and create information using digital technology, was positively associated with academic achievement among students. Similarly, van Laar et al. (2017) found that students with higher digital literacy, including the ability to use digital tools and navigate online environments, tended to perform better academically.

On the other hand, Margaryan et al. (2011) found no significant relationship between digital literacy and academic performance. Their study suggested that while students may be proficient in using digital technologies for social and entertainment purposes, they may not necessarily apply these skills effectively for academic learning. This emphasizes the need for education that specifically targets the development of digital literacy skills for academic purposes. These discrepancies may be attributed to variations in the definition and measurement of digital literacy, as well as differences in the student populations studied. As digital technologies continue to evolve and permeate all aspects of life, further research is needed to understand how digital literacy can best be fostered to enhance academic performance and prepare students for the digital demands of the workforce.

If a strong relationship exists between digital literacy and academic performance, it could suggest that improving digital literacy skills could lead to better academic outcomes. This could inform curriculum development and teaching strategies in the TVET programme. Moreover, the COVID-19 pandemic has accelerated the shift towards digital learning, making digital literacy even more crucial for students' academic success (Daniel, 2020). The sudden shift to remote learning highlighted the importance of digital literacy skills, as students who lacked these skills struggled to adapt to the new learning environment (OECD, 2020). Given the distinctive nature of the TVET programme, which combines theoretical knowledge with practical skills, it is crucial to examine the role of digital literacy within this context. This study aims to address this gap in the literature by investigating the relationship between digital literacy and academic performance among undergraduate students in the TVET programme.

This research aims to enrich the existing academic discourse by examining deeper into the relationship between student learning outcomes and digital literacy demands in the TVET sector. The findings could provide critical insights for educators, policy makers, and curriculum developers, thereby informing strategies to reinforce student performance and readiness for the digital workforce. The study takes into consideration the evolving educational landscape and the escalating significance of digital literacy in the 21st century. Given these considerations, it is clear that the relationship between digital literacy and academic performance is a complex and multifaceted issue that warrants further research.

## RESEARCH METHODS

This study employed a survey research design to assess the digital literacy levels of students enrolled in TVET programmes. The survey was carefully structured to capture multiple dimensions of digital literacy, ensuring a comprehensive understanding of students' competencies in using digital technologies effectively. The instrument comprised 30 test items evenly distributed across six key dimensions of digital literacy, aligning with frameworks established by UNESCO (2018) and OECD (2019). These dimensions were selected to reflect essential digital literacy required for academic success and professional readiness in today's digital economy.

The six dimensions of digital literacy included in this study were basic digital literacy, online information literacy, communication and collaboration, digital citizenship and online safety, critical thinking and problem-solving, and reflection and self-assessment. Basic digital literacy assessed students' proficiency in using fundamental digital tools such as operating systems, software applications, and hardware devices, which are crucial for academic and professional environments (UNESCO, 2018). Online information literacy measured students' ability to locate, evaluate, and effectively use digital information, a skill essential for academic research and decision-making (OECD, 2019). The communication and collaboration dimension evaluated students' capability to engage with digital platforms for academic discussions, teamwork, and virtual knowledge sharing. This is particularly relevant in contemporary education, where digital collaboration tools such as Google Docs, Microsoft Teams, and Zoom play an integral role in learning (Xiaodi, Yunus & Rafiq, 2024). The digital citizenship and online safety dimension examined students' understanding of ethical online behaviour, digital privacy, and cybersecurity practices, which are critical for navigating the digital space responsibly (Livingstone, Stoilova, & Nandagiri, 2020). The critical thinking and problem-solving dimension assessed students' ability to analyse information, solve problems, and make informed decisions using digital tools, as these competencies are increasingly necessary for both academic and workforce success (Punie & Redecker, 2017). Lastly, reflection and self-assessment focused on students' ability to evaluate their digital competencies, reflect on their digital practices, and identify areas for improvement. Self-regulated learning and continuous skill enhancement are vital in the rapidly evolving digital landscape.

The survey was administered digitally using WhatsApp, a widely used messaging platform among students. The link to the survey was shared with TVET students who had previously enrolled in the Information Technology in Education course, allowing for targeted participation. The decision to use WhatsApp as a distribution tool was based on its accessibility, cost-effectiveness, and ability to facilitate rapid response collection. Research has shown that using social media and instant messaging applications for survey distribution can enhance response rates, particularly among younger demographics who are highly engaged with these platforms (Taherdoost & Madanchian, 2025; Oluwatoyin & Nthabiseng, (2023). Furthermore, WhatsApp allows for real-time interaction and follow-up, which can encourage higher engagement and participation.

Despite these advantages, certain limitations exist in using WhatsApp for survey administration. One potential concern is low response rates, as participants may ignore or overlook survey links in a busy chat environment. This challenge was highlighted by Anderson (2019), who found that survey links disseminated through messaging platforms often receive lower response rates unless active engagement strategies are employed. To mitigate this, periodic reminders were sent to

participants to encourage survey completion. Another limitation is selection bias, as the sample may not be fully representative of the broader TVET student population. Students who are less active on WhatsApp or who lack access to smartphones may have been inadvertently excluded. However, this limitation was addressed by ensuring that the survey link was shared exclusively with TVET students and by cross-verifying participant identity. Additionally, data privacy concerns are a key ethical consideration in digital research. This study adhered to strict confidentiality measures by ensuring that responses were anonymous and accessible only to the main researcher, in alignment with best practices for ethical digital research and data protection guidelines.

The survey was designed to be concise and user-friendly, taking no more than 10–15 minutes to complete. Questions were structured in multiple-choice and Likert-scale formats to facilitate ease of response. Before survey administration, informed consent was obtained from all participants, ensuring that they were aware of the study's purpose, voluntary participation, and their right to withdraw at any stage. Transparency in research participation is critical, as it fosters trust and enhances data reliability (UNESCO, 2018). Additionally, demographic information was collected at the beginning of the survey to examine potential biases in the sample and to provide contextual understanding of the respondents.

The data collected from the survey responses were analysed using correlation analysis techniques to examine the relationship between students' digital literacy and academic performance. Correlation analysis is a widely used statistical approach in educational research for determining the strength and direction of relationships between variables (Field, 2018). The data analysis process involved several key steps. First, data cleaning and validation were conducted to remove incomplete or inconsistent responses, ensuring data accuracy. Next, descriptive statistics were calculated, including mean, standard deviation, and frequency distributions, to provide an overview of students' digital literacy levels. Finally, Pearson correlation analysis was used to assess the strength of the relationship between digital literacy scores and academic performance, offering insights into whether higher digital proficiency correlates with better academic outcomes (Pallant, 2020).

Overall, the methodology adopted in this study ensured a comprehensive and rigorous examination of digital literacy among TVET students. By leveraging WhatsApp for data collection, the study effectively utilized contemporary communication trends to reach a relevant audience. While digital survey distribution presents certain limitations, strategies such as periodic reminders, controlled sampling, and ethical research compliance were employed to mitigate these challenges. Future research should consider exploring additional variables influencing digital literacy, such as students' socio-economic background, access to digital infrastructure, and institutional digital support. By continuously refining digital literacy assessment methodologies, education stakeholders can develop more effective strategies to equip students with the necessary digital competencies for academic and professional success in an increasingly digitalized world.

## RESEARCH RESULTS

The data analysed in this study were obtained from a sample of 59 undergraduate students enrolled in the Information Technology subject, which is part of a TVET programme. This sample was drawn from a total population of 144 students, representing approximately 41% of the total population. Given the scope of this study, this sample size is considered substantial and sufficient for providing meaningful insights into the relationship between digital literacy and academic performance (Israel, 1992). Moreover, low response rates can introduce non-response bias which potentially affecting the representativeness of the findings (Dillman, Smyth, & Christian, 2014). Therefore, while the current sample allows for preliminary analysis, future studies should aim to increase participation to enhance the reliability and generalizability of the results. The data collected from the survey were analysed using descriptive statistics, distribution analysis, and correlation analysis to assess trends and relationships.

### Distribution of Digital Literacy and Academic Performance Scores

A visual inspection of the data distribution was conducted using histograms (Figure 1) alongside a Shapiro-Wilk test for normality. The findings indicated that digital literacy scores were not normally distributed, whereas academic performance scores exhibited a distribution closer to normality. Normality is a key consideration in statistical analysis, as many parametric tests assume data follow a normal distribution. The deviation from normality in digital literacy scores suggests that using non-parametric statistical methods may be more appropriate for analysing relationships between these variables.

The histogram of digital literacy scores (Figure 1, left) demonstrates a skewed distribution, suggesting that some students have significantly lower or higher digital literacy levels compared to the rest of the sample. This variation may indicate differences in students' prior exposure to digital tools, access to technology, or self-efficacy in using digital platforms. In contrast, the histogram of academic performance scores (Figure 1, right) suggests a more symmetrical and evenly spread distribution, meaning students' academic performance is more consistently distributed within the sample. The presence of a closer-to-normal distribution for academic performance scores implies that external factors influencing academic success may be more evenly distributed across students, while digital literacy vary more significantly.

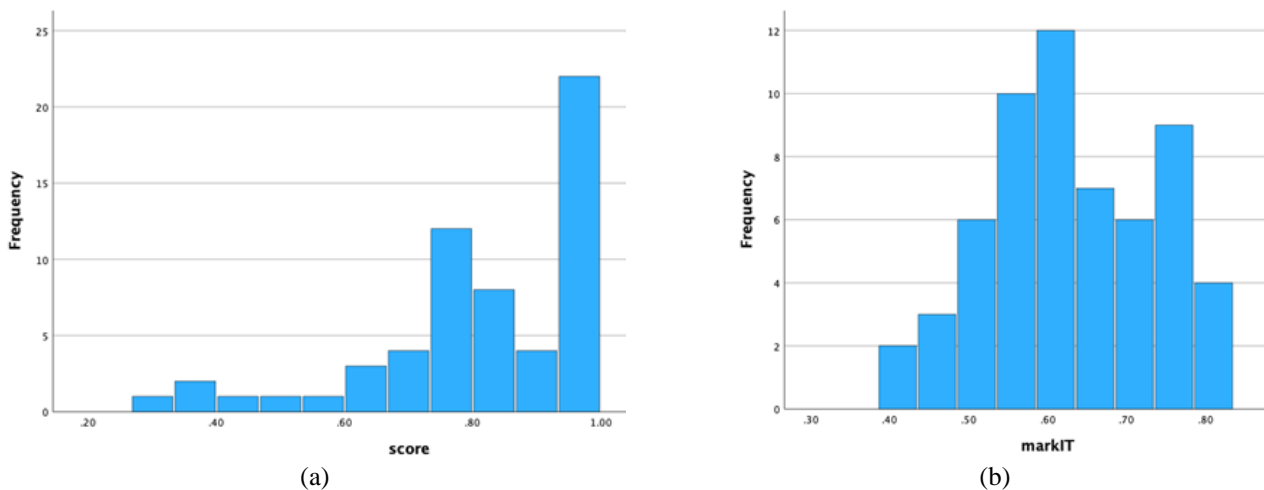


Figure 1. (a) The distribution of digital literacy score and (b) academic performance

### Descriptive Statistics

Descriptive statistical analysis was conducted to summarize the characteristics of both digital literacy and academic performance scores. The mean digital literacy score was approximately 24.63, with a standard deviation of 5.12, indicating a moderate level of variability in students' digital competencies. Similarly, the mean academic performance score was approximately 24.61, with a standard deviation of 5.12, suggesting a comparable level of dispersion. The similarity in means may imply that students with varying levels of digital literacy do not exhibit extreme variations in academic performance, although further statistical tests were needed to confirm this relationship. A closer look at the data suggests that some students demonstrated exceptionally high digital literacy, while others showed considerably lower scores, reflecting a diverse range of competencies within the sample. This variance may be attributed to different levels of prior exposure to technology, educational background, or familiarity with digital tools. In contrast, academic performance scores were distributed more consistently, with fewer extreme outliers.

### Correlation Analysis

To examine the relationship between digital literacy and academic performance, Spearman's correlation coefficient was calculated. Spearman's correlation is a non-parametric test suitable for analysing relationships between variables that are not normally distributed. The analysis revealed a correlation coefficient of approximately 0.349, which is statistically significant ( $p < 0.05$ ), indicating a weak to moderate positive correlation between digital literacy and academic performance. This suggests that students with higher digital literacy tend to perform better academically, though the strength of the relationship is not strong. The positive correlation implies that digital literacy may play a role in academic success, but it is likely not the sole determinant. Other factors such as study habits, motivation, prior knowledge, and instructional quality may also contribute to students' academic outcomes. While students with stronger digital literacy may have advantages in accessing online learning materials, engaging with digital tools, and efficiently processing information, these benefits do not translate into a strong direct impact on academic performance.

The relatively low to moderate correlation coefficient also suggests variability in how digital literacy influences academic success. Some students with high digital literacy may still struggle academically due to other academic challenges, while some students with lower digital literacy scores may perform well through traditional study methods and strong foundational knowledge. This finding aligns with prior research indicating that while digital literacy can enhance learning experiences, it does not always guarantee higher academic performance unless accompanied by effective learning strategies and engagement.

The results highlight important implications for educators and policymakers in the TVET programme. While digital literacy is a valuable skill for academic and professional success, its direct impact on academic performance remains limited. This suggests that universities and TVET institutions should focus on not only enhancing digital literacy but also integrating it with effective learning strategies, critical thinking skills, and subject-specific knowledge acquisition. Given the non-normal distribution of digital literacy scores, future research should explore factors influencing students' digital literacy levels, such as access to technology, prior digital exposure, and self-regulated learning strategies. Additionally, while the findings indicate a positive correlation, further investigation using multiple regression analysis or structural equation modelling could provide deeper insights into how digital literacy interacts with other academic success factors.

In summary, while the study confirms that higher digital literacy is generally associated with better academic performance, the relationship is not strong enough to suggest causation. This reinforces the need for a holistic approach to academic development, where digital literacy is complemented by pedagogical support, engagement strategies, and subject-specific skill-building. Future studies could explore how different teaching methodologies, digital interventions, and blended learning environments affect the relationship between digital literacy and academic performance in the TVET context.

## DISCUSSION

The present study aimed to explore the relationship between digital literacy and academic performance among undergraduate students enrolled in the Information Technology subject and TVET programme. The findings revealed interesting comprehensions into the nature of this relationship. The correlation analysis revealed a weak to moderate positive correlation between digital literacy and academic performance. This implies that higher digital literacy scores tend to be associated with higher academic performance scores, although the relationship is not particularly strong. It is worth noting that correlation coefficients range from -1 to +1, where values close to -1 or +1 indicate a strong relationship, while values close to 0 indicate a weak or no relationship. Therefore, the observed correlation suggests a tendency for students with higher digital literacy scores to achieve better academically, but other factors may also contribute to academic performance.

There are a few interesting findings worth discussing in item analysis. First, one of the items in the Digital Literacy measurement is about "What is a CAPTCHA used for?" Interestingly, the study revealed that only 59% of students were able to answer the question correctly. This highlights a gap in their understanding of online security practices. Digital literacy encompasses the ability to use digital technologies effectively, navigate online platforms, and understand concepts related to the digital world. In this case, the lack of understanding regarding CAPTCHAs indicates a potential deficiency in specific aspects of digital literacy, particularly in online security. CAPTCHAs are an important component of online security measures. By not recognizing the purpose and function of CAPTCHAs, students may demonstrate a lack of awareness or knowledge about the importance of safeguarding digital information and protecting against online threats.

Second, only 63.9% of students were able to provide a correct answer when asked about the concept of a "digital footprint" suggests a moderate level of understanding or awareness among the students. Understanding the concept of a digital footprint is important for students for managing online reputation. Students' online activities and interactions can contribute to their digital reputation, which can have a long-lasting impact on their personal and professional lives. TVET students often enter vocational fields where employers increasingly rely on digital platforms for recruitment and evaluation. Understanding digital footprints allows students to cultivate a positive online presence that aligns with their career goals. By effectively managing their digital reputation, TVET students can enhance their employability, attract potential employers, and present themselves as competent professionals in their respective fields. Furthermore, a well-managed digital footprint can provide evidence of their expertise, creativity, and dedication, leading to increased industry recognition and credibility. Potential employers, clients, or collaborators can view their digital footprint as a testament to their capabilities, further enhancing their professional reputation. Thirdly, the results of the item analysis revealed another interesting finding related to students' understanding of synchronous and asynchronous communication in the context of online collaboration. Surprisingly, only 70% of students were able to answer the question correctly. This finding suggests that experiencing online learning during the pandemic did not necessarily equip them with a solid understanding of this fundamental concept.

In conclusion, this study highlights the critical significance of integrating digital literacy skills into the curriculum of TVET programmes, with a particular emphasis on online security, digital footprint management, and the efficient use of digital tools. One possible effective approach is to embed these competencies across existing vocational courses or subjects rather than treating them as standalone modules. For instance, cybersecurity literacy such as safe browsing, password protection and phishing awareness can be integrated into technical courses that require internet use. Similarly, lessons on managing one's digital footprint and online identity can be included in communication or career readiness modules, where students learn how their online presence impacts employability and professional credibility.

While Malaysian Qualification Agency (MQA) have embedded digital skills under the Functional Work Skills cluster in the Malaysian Qualifications Framework (MQF 2.0), educational institutions must take more effective actions to ensure these policies are meaningfully executed at the ground level. Institutions can operationalize these policy intentions by translating them into clear, measurable learning outcomes across TVET programmes with specific emphasis on digital responsibility, ethical online behaviour, and the use of industry-relevant digital tools. Furthermore, institutions can actively engage in curriculum reviews, provide feedback to policy bodies and develop localized implementation strategies that reflect the realities of their learners and teaching environments. By fostering cross-functional collaboration between curriculum developers, instructors and administrative bodies, institutions can bridge the gap between national policy and classroom practice, by doing so, it can accelerate the digital transformation agenda envisioned under MQF 2.0.

By instilling these skills, TVET institutions equip students with the skills necessary to thrive in the digital age. This comprehensive integration ensures that students are not only capable of navigating the complexities of the digital landscape responsibly but are also skilful at protecting their online presence. Moreover, by effectively using digital resources, students can enhance their vocational skills and discover promising career opportunities, thereby maximizing their success potential in the digital age.

## CONCLUSION

This study highlights the relationship between digital literacy and academic performance among undergraduate students in the TVET programme. This study defines digital literacy as the ability to use digital technologies to communicate, access information, and perform tasks effectively. While academic performance is the grades students earn

in their previous exams. The findings reveal a weak to moderate correlation, suggesting that students with stronger digital competencies tend to achieve better academic results. These insights underscore the growing importance of digital literacy in higher education, particularly in the TVET context, where technology plays a crucial role in learning and professional development. To bridge the gap between digital literacy and academic success, universities should integrate structured digital literacy courses into their curriculum, providing students with practical opportunities to enhance their technological proficiency. Additionally, policymakers and educators must prioritize digital literacy development as a fundamental aspect of academic preparation, ensuring students are equipped to meet the demands of an increasingly digitalized workforce.

Future research should explore additional factors influencing the relationship between digital literacy and academic performance, such as students' engagement with digital learning tools, self-efficacy in using technology, and institutional support mechanisms. By continuously adapting to the evolving digital landscape, higher education institutions can better prepare students for academic excellence and long-term career success in the ever-changing global economy.

## ACKNOWLEDGEMENT

This research was made possible by funding from research grant number Q185 (TIER 1) provided by Universiti Tun Hussein Onn Malaysia.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## AUTHORS CONTRIBUTION

Marlina Mohamad as a Corresponding Author led the research, do the analysis and managed manuscript preparation. Asiah Mohamad as a Co-Author handled data collection and preliminary processing.

Abdul Jalil Omar as a Co-Author developed the research framework and edited the manuscript.

All authors contributed intellectually and approved the final version.

## REFERENCES

- Allister, K. (2016). Digital Literacy in Education: A Report. UNESCO. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000244628>
- Anderson, T. (2019). Challenges and opportunities for use of social media in higher education. *Journal of Learning for Development*, 6(1), 6-19.
- Choy, S., Wärvik, GB., Lindberg, V. (2018). Integration between school and work: Developments, conceptions and applications. In: Choy, S., Wärvik, GB., Lindberg, V. (eds). *Integration of Vocational Education and Training Experiences. Technical and Vocational Education and Training: Issues, Concerns and Prospects*, vol 29. Springer, Singapore.
- Daniel, J. (2020). Education and the COVID-19 pandemic. *Prospects*, 49(1-2), 91-96.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method* (4th ed.). Wiley.
- Erens, B., Burkill, S., Couper, M. P., Conrad, F., Clifton, S., Tanton, C., & Prah, P. (2014). Nonprobability web surveys to measure sexual behaviors and attitudes in the general population: A comparison with a probability sample interview survey. *Journal of Medical Internet Research*, 16(12), e276.
- Field, A. (2018). *Discovering statistics using IBM SPSS statistics*. SAGE Publications.
- Helsper, E. J., & Eynon, R. (2010). Digital natives: where is the evidence? *British Educational Research Journal*, 36(3), 503-520.
- Israel, G. D. (1992). Determining Sample Size. University of Florida Cooperative Extension Service. Retrieved from <https://www.psychosphere.com/Determining%20sample%20size%20by%20Glen%20Israel.pdf>
- Junco, R., & Cotten, S. R. (2012). No A 4 U: The relationship between multitasking and academic performance. *Computers & Education*, 59(2), 505-514.
- Kirschner, P. A., & Karpinski, A. C. (2010). Facebook® and academic performance. *Computers in Human Behavior*, 26(6), 1237-1245.
- Livingstone, S., Stoilova, M., & Nandagiri, R. (2020). Children's data and privacy online: Implications for digital skills. *Media and Communication*, 8(2), 4-14.
- Margaryan, A., Littlejohn, A., & Vojt, G. (2011). Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education*, 56(2), 429-440.

- Nikou, S., & Aavakare, M. (2021). An assessment of the interplay between literacy and digital Technology in Higher Education. *Education and Information Technologies*, 26(4), 3893–3915.
- OECD. (2019). OECD skills outlook 2019: Thriving in a digital world. Organisation for Economic Co-operation and Development. Retrieved from <https://www.oecd.org>
- OECD (2020), “A framework to guide an education response to the COVID-19 Pandemic of 2020,” OECD Policy Responses to Coronavirus (COVID-19), OECD Publishing, Paris.
- Oluwatoyin Ayodele Ajani, & Nthabiseng B. Khoalenyane. (2023). Using Whatsapp as a tool of learning: A systemic literature review of prospects and challenges. *International Journal of Innovative Technologies in Social Science*, 3(39), 1-15.
- Pallant, J. (2020). SPSS survival manual: A step-by-step guide to data analysis using IBM SPSS. Routledge.
- Punie, Y., editor(s), Redecker, C., (2017) European Framework for the Digital Competence of Educators: DigCompEdu, EUR 28775 EN, Publications Office of the European Union, Luxembourg, JRC107466.
- Selwyn, N., Hillman, T., Eynon, R., Ferreira, G., Knox, J., Macgilchrist, F., & Sancho-Gil, J. M. (2021). What’s next for Ed-Tech? Critical hopes and concerns for the 2020s. *Learning, Media and Technology*, 46(1), 1-6.
- Taherdoost, H. & Madanchian, M. (2025). The Impact of Survey Response Rates on Research Validity and Reliability. In A. Rahal & M. Adorján (Eds.), *Design and Validation of Research Tools and Methodologies* (pp. 177-206). IGI Global Scientific Publishing.
- UNESCO. (2018). Digital skills for life and work. United Nations Educational, Scientific and Cultural Organization. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000259013.locale=en>
- van Laar, E., van Deursen, A. J., van Dijk, J. A., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, 72, 577-588.
- Xiaodi, Y., Yunus, M. M., & Rafiq, K. R. M. (2024). Digital Collaborative Learning in Higher Education: A Systematic Review. *International Journal of Academic Research in Progressive Education and Development*, 13(1), 1110–1122.