Journal of Advances and Scholarly Researches in Allied Education
Vol. 21, Issue No. 5, July-2024, ISSN 2230-7540

DOI: https://doi.org/10.29070/y7yjcw45

The role of digital literacy in Enhancing Technical Learning for Adult Learners: A Systematic Review

Satheesh Chandra Babu S [1] * , Dr. Lavi Saxena [2]

1. Research Scholar, University of Technology, Jaipur, Rajasthan, India
satheeshchandrababu@gmail.com ,
2. Professor, Department of Education, University of Technology, Jaipur, Rajasthan, India

Abstract: This report provides a thorough literature analysis on the topic of digital literacy and its impact on improving technical learning outcomes for adult learners enrolled in online distance education programs. This research looks specifically at programs that are quite technical in nature and finds and analyses the internal, external, and institutional problems that come from not having enough digital competences. It proves that being able to use digital tools effectively is crucial for succeeding in school and getting all of your assignments done on time, not just an extra talent. Cognitive overload, decreased engagement, increased anxiety, and a greater chance of dropping out were seen among adult learners with inadequate digital abilities. Several psychological, social, and infrastructure-related aspects are interrelated with digital literacy, as the review shows. Poor student performance is mostly attributable to obstacles including restricted access to technology, digital fear, and an absence of institutional support. According to the results, adult learners' digital preparedness is affected by their socioeconomic status, their level of previous exposure to technology, and the availability of institutional support mechanisms. According to the data, universities that offered digital interventions including orientation sessions before classes started, help desk services, and adaptive learning materials had higher results for their students. The report proposes a range of tactics and policies that are responsive to context in order to tackle these issues. National policies should be put in place to guarantee that all students have equal access to digital learning opportunities, and these should include things like digital literacy tests, faculty training to help students from varied backgrounds, and the integration of digital literacy modules into early technical curriculum. In order to help adult learners thrive in online technical education, the article says that digital literacy must be approached holistically and inclusively.

Keywords: Digital literacy, adult learners, online technical education, learning barriers, digital readiness

X

INTRODUCTION

The current education environment has seen the emergence of digital literacy as a core ability, particularly for adult learners who are involved in technical courses through online distance education. It comprises the functionality of locating, evaluating, creating, and communicating information through the use of digital technology. In the context of technical education, digital literacy encompasses more than just the ability to use a computer as a basic tool; it also encompasses the ability to navigate learning management systems, participate in virtual laboratories, code, manage digital information, and solve technical problems using digital tools. Adult learners need to have basic digital skills in order to be successful in learning settings that are structured around technical subjects since these courses frequently entail interaction with complicated software and systems (Franklin, 2022; Costa, 2023).

It is important to note that the significance of this study rests in the rapid growth of online learning platforms as well as the growing need for further training in digital and technological fields. Because of its

flexibility and accessibility, online education has become more popular among adult learners, many of whom are returning to school after major breaks in their careers or lives. To a large extent, however, the effectiveness of such initiatives is contingent upon their level of digital preparedness. When adult learners lack the necessary digital literacy, they are confronted with obstacles that impede their capacity to fully interact with technological content and platforms, which ultimately leads to poor academic achievement or withdrawal from the educational system (Briggs, 2023; Watanabe, 2022).

There are frequently several facets to these difficulties. Cognitive load, emotional aversion to technology, limited exposure to digital settings, and socio-economic restrictions are all things that are frequently noted among adult learners. Disengagement and low completion rates in technical courses are further contributed to by factors such as the absence of prior training, the absence of peer connection, and feelings of isolation (Neumann, 2023; Singh, 2022).

Since the beginning of the twenty-first century, digital literacy has evolved from a supplementary ability to a fundamental prerequisite in the field of education. This transition was hastened by the COVID-19 epidemic, which made online platforms the default method of instruction and forced even learners who were unwilling to enter digital areas. As a result of this transformation, adult learning frameworks have been rethought, necessitating the development of new policies, infrastructure, and pedagogies (Legrand, 2023; Das, 2022).

Current data from around the world indicate that there has been a consistent rise in the number of adults participating in online technical education; nonetheless, dropout rates continue to be high, particularly among students who exhibit a lack of digital ability. National digital inclusion policies have been implemented in countries such as Australia, Canada, and Germany in order to effectively address this gap and provide assistance for adult learners through the implementation of focused interventions (Martins, 2022; Choi, 2023).

The primary aim of this study was to conduct a systematic review of scholarly literature that explores the role of digital literacy in enhancing technical learning for adult learners enrolled in online distance education. The review aimed to identify digital literacy-related barriers, highlight successful institutional practices, and offer policy-level recommendations to improve learner outcomes.

In the course of conducting a comprehensive literature study, we relied solely on secondary data obtained from academic journal papers that were subjected to peer review. In this study, neither primary data collecting nor statistical analysis were carried out. There were only empirical studies that focused on adult students who were enrolled in online technical education programs that placed an emphasis on digital literacy that were considered for inclusion. It was necessary for the research to be published after the year 2000. The review did not include any theoretical articles, editorials, conference proceedings, or investigations that were not associated with formal degree-oriented learning. ERIC, Web of Science, SAGE Journals, SpringerLink, ScienceDirect, Wiley, and Taylor & Francis were among the academic databases that were utilised in order to obtain papers that were pertinent to the study. "Digital literacy," "adult learners," "online technical education," "learning barriers," and "digital skills" were some of the terms that were utilised in the search.

DIGITAL LITERACY AND ITS IMPORTANCE IN ONLINE TECHNICAL

EDUCATION

One of the most important factors that contributes to effective participation in online technical education is familiarity with digital technology. It goes beyond the ability to operate a computer and encompasses a wide range of abilities, including the ability to access digital information, use online learning platforms, manage cloud-based tools, engage with virtual simulations, and comprehend data-driven resources. When it comes to adult learners, digital literacy acts as a doorway to comprehending and mastering technical knowledge, which is sometimes difficult to comprehend and requires a significant amount of contact with digital tools. It is possible that adult learners will have difficulty navigating the course structure or applying the information obtained to real-world problems if they do not possess basic digital literacy. This will result in a reduction in the learning outcomes for these learners (Greene, 2023; Nakamura, 2022).

In the field of technical education, digital literacy is an extremely important factor in determining how students comprehend the material covered in the course, interact with multimedia content, and carry out practical exercises. Computing, engineering simulations, and data analysis are only few of the technical disciplines that need expertise in navigating specialised software and completing tasks inside digital ecosystems. Other technical courses include computer programming and engineering simulations. A learner's ability to search for relevant material, participate in interactive lessons, finish projects, and communicate successfully in digital forums are all impacted by their level of digital literacy. When adult learners are lacking in certain competences, they are more likely to experience difficulty in learning the material and meeting the objectives of the course (Hoffman, 2023; Lindgren, 2022).

Additionally, foundational digital abilities contribute to learner autonomy, which is necessary in contexts that are typical of online technical education and are characterised by asynchronous and self-paced learning. Adult learners who have a good digital literacy are more competent to manage their learning schedules, provide solutions to frequent technological problems, and adapt to a variety of learning methods. These qualities help students develop a sense of self-confidence and lessen their reliance on institutional assistance, which ultimately leads to increased academic perseverance and success. Furthermore, digital fluency helps to foster the development of abilities such as critical thinking and problem-solving, which are essential components of technical disciplines and learning that continues throughout one's life (Moretti, 2023; Yang, 2022).

SOCIOECONOMIC AND PSYCHOLOGICAL FACTORS INFLUENCING DIGITAL LITERACY

A significant factor that determines whether or not an adult learner has access to digital technology and how proficient they are in using them is their socioeconomic background. Individuals who come from homes with lower incomes sometimes have restricted access to computing equipment, internet connections that are dependable, and possibilities for digital training. Due to the fact that rural communities may lack the required infrastructure for persistent digital participation, this imbalance is further exacerbated by the geographic barrier between rural and urban areas. Additionally, job status is a factor that impacts the acquisition of digital literacy. Full-time workers may have less time and flexibility to learn new digital skills, whereas those who are unemployed may not prioritise or afford digital learning without the help of an institution (Fernandez, 2023; Okoro, 2022).

Additionally, psychological variables have a significant impact on the level of digital literacy among adult learners. Participation in digital learning settings is frequently discouraged by digital anxiety, which is characterised by a fear of utilising technology or making errors online. When it comes to engaging with new software or online platforms, a significant number of individuals, particularly those who have been excluded from formal schooling for a considerable amount of time, exhibit low levels of self-confidence. Mistakes made in the past, a lack of exposure to technology, or variances in learning preferences between generations might all be potential causes of this aversion to technology. Due to this, individuals could avoid interacting with the material covered in the course, put off completing projects, or rely excessively on assistance from other sources, all of which hinders their ability to learn independently (Sethi, 2023; Abiola, 2022).

Learner outcomes in technical education are collectively influenced by these socioeconomic and psychological factors, which are strongly intertwined with one another within the field. There is a higher likelihood that students who come from underprivileged homes and who also suffer high levels of digital anxiety may have difficulty progressing through the course and remembering the material. Learners that fall within this category frequently express a lower level of contentment with their online education and are at a greater risk of dropping out when they experience emotions of frustration and inadequacy. Therefore, it is vital to address these variables not only to enhance the performance of individual learners but also to ensure that digital technical programs are accessible to all members of society and that they are successful (Hamada, 2022; Zhu, 2023).

INSTITUTIONAL INTERVENTIONS FOR PROMOTING DIGITAL READINESS

Adult learners have been supported in acquiring digital readiness through the implementation of many targeted interventions by educational institutions all over the world. These interventions have been notably focused on technical education that is offered through online platforms. The implementation of pre-course digital skill modules is likely one of the techniques that has gained the most widespread acceptance. These onboarding programs are intended to acquaint students with the many digital tools and platforms that they will be exposed to over the duration of their degree program. Structured digital orientation sessions have been implemented into educational institutions in countries such as the United Kingdom, Singapore, and Canada. These sessions are designed to assist adult learners in becoming familiar with navigation, communication tools, and learning management systems before they begin interacting with technical material (Turner, 2023; Alvarez, 2022).

Learning support systems, in addition to pre-course modules, are an essential component in ensuring that students remain engaged in digital activities throughout time. Helpdesks, peer mentorship programs, and technical support services that are available around the clock have been developed by institutions in order to give instant assistance. Assessments of digital literacy are also provided by certain educational institutions at the beginning of the academic semester in order to discover any deficiencies in the digital abilities of students. Through the use of these evaluations, educational institutions are able to provide individualised interventions that are suited to the specific requirements of each learner. This ensures that all students possess the requisite skills before moving on to more difficult technical modules (Gomez, 2023;

Larsen, 2022).

By reducing structural barriers, inclusive institutional policies further strengthen digital inclusion and encourage everyone to participate. The provision of access to subsidised equipment, free internet subscriptions, and open educational materials are all included in this. Additionally, a number of educational establishments have updated their curricula in order to incorporate digital literacy components into the overall framework of the course, rather than considering these skills as independent abilities. For the purpose of catering to the varied requirements of students, extra measures such as flexible deadlines, modular course designs, and assistance in many languages have been included. These institutional initiatives have the goal of establishing a digital learning environment that is egalitarian, in which adult learners are able to feel supported, confident, and capable of achieving success in technical education classes (Niemi, 2023; Duarte, 2022).

IMPACT OF DIGITAL SKILL DEFICIENCY ON LEARNING OUTCOMES

A lack of digital skills among adult learners in online technical education significantly hinders learning outcomes. Poor digital literacy directly affects learners' ability to engage with course materials, participate in online discussions, and navigate virtual platforms. Many adult learners face difficulties in submitting assignments on time due to unfamiliarity with digital tools or confusion regarding submission procedures. Furthermore, inadequate skills in using email, forums, and learning management systems reduce the frequency and quality of communication with instructors. This communication gap often leads to misunderstandings, missed deadlines, and poor academic performance (Barros, 2023; Iqbal, 2022).

Subjects that are considered technical often feature information that is more complicated and necessitate for the utilisation of specialised software or simulation tools. Learners who are not adequately equipped for digital technology have an extra obstacle in the form of the technical character of these disciplines. Learners who have a poor level of digital competency frequently have difficulty with independently installing, operating, or troubleshooting software of this kind. These difficulties lead to feelings of irritation and worry, particularly in situations when students are unable to address problems in a timely manner or do not obtain help in a timely manner. Because of this, the likelihood of dropping out of a technical program is substantially higher than the risk of dropping out of a non-technical one. Several studies have found that adult students who have a poor understanding of digital technology are more likely to drop out of the course early on, frequently claiming feelings of powerlessness and a lack of confidence as the reasons for their disengagement (Sharma, 2023; Delgado, 2022).

The records of the institution and the findings of research studies have indicated recurrent trends in which students who have poor digital abilities do poorly on tests, exhibit sporadic attendance in synchronous sessions, and have worse retention rates. In many instances, educational institutions see greater withdrawal rates among first-time members of the online learning community who are lacking in fundamental digital competence. At the same time as these trends highlight the crucial relevance of digital preparedness as a requirement for effective participation in online technical education, they also highlight the urgent necessity for proactive institutional initiatives (Arun, 2022; Mendez, 2023).

ANALYSIS AND FINDINGS OF SYSTEMATIC LITERATURE REVIEW

Sr. No.	Thematic Area	Key Findings	Authors
1	Internal Barriers	Low digital self-efficacy, cognitive overload, lack of motivation, poor self-regulation	Greene (2023), Nakamura (2022), Hoffman (2023)
2	External Barriers	Work-family imbalance, inadequate learning environments, lack of access to digital tools	Fernandez (2023), Okoro (2022), Zhu (2023)
3	Institutional Challenges	Poor course design, limited digital infrastructure, lack of faculty support and adaptive models	Turner (2023), Duarte (2022), Niemi (2023)
4	Digital Skill Deficiency	Inability to navigate platforms, low engagement, delayed submissions, poor communication	Barros (2023), Mendez (2023), Delgado (2022)
5	Dropout Behavior	High dropout and low retention linked to digital unpreparedness and combined challenges	Arun (2022), Sharma (2023), Iqbal (2022)
6	Socioeconomic and Psychological Factors	Digital anxiety, low confidence, income disparity, rural-urban divide	Abiola (2022), Sethi (2023), Hamada (2022)
7	Institutional Interventions	Pre-course digital training, helpdesk support, literacy assessments, inclusive infrastructure	Gomez (2023), Larsen (2022), Alvarez (2022)
8	Global Policy and Practice Models	Flexible learning models, learner-centric pedagogy, faculty training, modular digital literacy	Choi (2023), Martins (2022), Legrand (2023)

9	Best Practices in Digital Inclusion	Subsidized devices, multilingual resources, blended learning pathways, adaptive courseware	Niemi (2023), Duarte (2022), Turner (2023)

According to the findings of the comprehensive literature review, adult students who are enrolled in online technical education face a variety of interrelated challenges that have their origins in the internal, external, and institutional spheres. Internally, learners struggle with low levels of self-confidence, limited prior exposure to digital tools, and weak skills in self-management. The external pressures that include time constraints, responsibilities for caregiving, and poor home learning conditions all contribute to the exacerbation of these internal and external limitations. As a further point of interest, many educational establishments have not yet fully adapted their course delivery models to accommodate the particular digital requirements of adult learners. In technical programs, the combination of these factors results in a decrease in digital engagement, irregular participation, and an increase in the number of students who drop out of education.

It has been demonstrated through institutional interventions and policy practices from a variety of global contexts that these challenges can be mitigated through the implementation of strategies that are both inclusive and innovative. According to research, educational institutions that provide pre-course digital literacy modules, structured learner support, and continuous faculty development have demonstrated improved outcomes in terms of learner satisfaction and retention. A further reduction in barriers is achieved through the incorporation of digital readiness into the core curriculum, as well as through the implementation of context-aware infrastructure, which includes multilingual content and subsidised digital access. The results highlight the fact that adult learners need not only access to the internet but also ongoing digital empowerment in order to be successful in online technical education as well. The findings of this analysis lend credence to the demand for comprehensive reforms and targeted assistance in order to establish digital learning environments that are both equitable and effective for adults.

STRATEGIES FOR IMPROVING DIGITAL LITERACY AMONG ADULT LEARNERS

Increasing the level of digital literacy among adult students who are enrolled in online technical education needs concerted efforts on the part of both policymakers and educational institutions. It is imperative that governments make the creation of national digital education frameworks a top priority at the policy level. These frameworks should centre on the concepts of digital inclusion and lifelong learning. In addition to ensuring that all individuals have equitable access to digital infrastructure, these frameworks should also develop funding mechanisms for adult education programs and require minimum digital competency criteria for students who enrol in online technical courses. Policies should also foster cooperation between educational institutions, technology providers, and community organisations in order to broaden the scope of digital education programs and increase their relevance.

Redesigning the curriculum to incorporate the development of digital skills at the beginning stages of technical programs is one of the most successful solutions that can be used immediately. Instead than

approaching digital literacy as a talent that is either required or optional, it need to be incorporated into the fundamental curriculum and taught in a step-by-step manner. For the purpose of bolstering learners' self-assurance prior to the introduction of more sophisticated technical information, introductory courses that cover topics such as navigating learning platforms, using productivity tools, engaging in digital communication, and maintaining online resources might be beneficial. These fundamental courses should also be matched with real-world scenarios in order to assist adult learners in comprehending the practical application of their digital abilities in the job and in everyday life.

The creation of faculty is another essential component in the process of promoting digital literacy among adult learners. Not only should teachers receive training in digital tools and technology, but they should also receive training in adult learning theories, inclusive pedagogy, and individualised instruction. It is necessary for faculty members to be prepared with the ability to recognise different degrees of digital competence and to provide targeted help by means of personalised feedback, flexible communication techniques, and adaptive learning methodologies. The capacity of faculty members to successfully connect with adult learners may be improved by the implementation of regularly scheduled seminars, certifications, and peer mentoring programs. When it comes down to it, a mix of legislative reform, curriculum innovation, and faculty readiness is required in order to construct an adult learning environment that is digitally enabled.

CONCLUSION

It was discovered via the comprehensive examination of the relevant literature that digital literacy was a significant factor in predicting the level of success that adult students achieved in online technical education. It was discovered that it was more than just a supporting ability; rather, it served as a core necessity for interacting with the material of the course, navigating platforms, completing assessments, and maintaining continuous contact with instructors. The adult learners who exhibited greater levels of digital competence had superior learning outcomes, increased involvement in the course, and higher retention rates in comparison to the adult learners who were not adequately equipped for the digital environment. Deficits in digital skills were shown to be related with increased dropout rates, delayed assignment submissions, and reduced participation, particularly in courses that required a high level of technical expertise.

Additionally, the studies brought to light the interrelated nature of digital literacy with a variety of social, institutional, and psychological issues through their findings. Adult learners who came from socioeconomically challenged homes or who lived in rural regions experienced significant difficulties in gaining digital skills owing to a lack of access to resources and additional resources. On a psychological level, learning was further hampered by characteristics such as digital anxiety, low self-confidence, and hostility to technology. On the institutional front, a rising gap between the needs of technical learning and the capacities of learners was contributed to by rigid course design, insufficient faculty assistance, and poor onboarding. A compounding effect was formed as a result of these interrelated obstacles, which had a major impact on the performance of learners and their ability to persevere.

When these findings are taken into consideration, there is a significant demand for context-sensitive tactics and legislative reforms that will make digital education more accessible to adult learners and more responsive to their requirements. Pre-course training, embedded digital skill modules, and robust learner

support systems are all examples of ways in which educational institutions should demonstrate their commitment to fostering digital readiness. In order to eliminate structural barriers and guarantee that everyone has equal access to digital education, national and institutional policies should collaborate at the same time. Furthermore, members of the teaching staff need to be prepared with the knowledge and abilities necessary to engage adult students who have varied degrees of digital competency. For the purpose of empowering adult learners and maintaining lifelong learning in technical areas, it is vital to use a strategy that is both comprehensive and inclusive.

References

1. Abiola, R. A., & Menendez, C. J. (2022). Technology resistance and confidence issues among adult digital learners. Journal of Adult Digital Education, 14(2), 132–147.
2. Alvarez, M. C., & Pinto, L. R. (2022). Designing effective digital onboarding programs for adult learners. Journal of Lifelong Learning Innovation, 27(1), 92–106.
3. Arun, K. P., & Dasari, N. L. (2022). Early withdrawal trends among digitally underprepared adult learners. Journal of Educational Continuity and Access, 23(1), 75–89.
4. Barros, F. J., & Velasco, M. T. (2023). Communication barriers in online technical learning: A digital literacy perspective. Journal of Online Academic Engagement, 20(3), 142–157.
5. Briggs, H. M., & Nolan, R. P. (2023). Digital learning adaptation and adult education: A global perspective. Journal of Continuing Digital Education, 29(2), 115–130.
6. Choi, E. Y., & Zafar, L. H. (2023). National policies on digital inclusion and their implications for adult learners. Global Journal of Educational Strategies, 18(1), 62–78.
7. Costa, V. R., & Molina, D. T. (2023). Navigating online platforms: Digital skills and challenges among adult technical learners. International Review of Adult Learning, 31(3), 199–212.
8. Das, R. K., & Menendez, F. G. (2022). The post-pandemic shift in adult education: Rethinking digital literacy. Journal of Online Teaching and Technology, 25(4), 144–159.
9. Delgado, S. K., & Noor, A. M. (2022). Technical learning complexity and its effect on dropout risk. International Journal of Distance Learning Studies, 25(2), 112–127.
10. Duarte, H. F., & Salim, R. Y. (2022). Promoting inclusive digital access through institutional policy reforms. International Journal of Adult Education Practice, 20(3), 145–161.
11. Fernandez, G. M., & Chong, L. Y. (2023). Socioeconomic disparities in digital skill acquisition among adult learners. Education and Inequality Journal, 17(1), 88–104.
12. Franklin, J. A., & Tan, Y. C. (2022). Digital readiness and academic performance in adult distance education. Journal of Digital Pedagogy and Practice, 17(3), 89–104.
13. Gomez, J. L., & Faria, M. N. (2023). Personalized digital literacy assessments in technical education.

Educational Technology and Learning Support, 18(2), 118–133.

14. Greene, P. H., & Zhao, S. K. (2023). Empowering adult learners through digital skills in virtual technical education. Journal of Educational Empowerment, 21(1), 84–98.
15. Hamada, T. K., & Ricci, S. N. (2022). Digital divides and learner outcomes in technical online programs. International Journal of Education and Digital Development, 24(3), 161–176.
16. Hoffman, T. E., & Delgado, M. R. (2023). Learner navigation and performance in digital environments: A study of technical education. Online Technical Education Review, 18(2), 142–159.
17. Iqbal, R. S., & Tanaka, J. H. (2022). Digital skills and adult learner performance in remote technical education. Adult Education and Technology Review, 28(4), 134–150.
18. Larsen, T. M., & Koenig, A. H. (2022). Institutional digital support models in online education for adults. Global Review of Adult Education Systems, 21(4), 127–141.
19. Legrand, C. L., & Ito, N. S. (2023). Adult learning frameworks and the digital shift: Policy and practice insights. Journal of Lifelong Education Policy, 19(2), 75–91.
20. Lindgren, F. J., & Patel, R. D. (2022). Digital fluency in technical training programs for adults. Journal of Applied Learning Technologies, 26(4), 121–136.
21. Martins, F. O., & Rhee, J. D. (2022). International digital literacy programs and adult engagement in technical learning. Education and Technology Perspectives, 22(1), 131–147.
22. Mendez, L. R., & Duarte, K. P. (2023). Institutional data analysis on digital literacy and course completion. Journal of E-Learning Retention Research, 19(2), 101–115.
23. Moretti, A. V., & Janssen, L. P. (2023). Building autonomy through digital literacy in adult education. International Journal of Learning Technology Integration, 30(3), 97–112.
24. Nakamura, L. M., & Torres, Y. C. (2022). Digital literacy and its impact on technical subject mastery in adult learners. Education and Digital Competency Journal, 15(2), 65–80.
25. Neumann, T. C., & Varga, B. E. (2023). Overcoming cognitive and psychological barriers in adult digital learning. Journal of Adult Learning and Behaviour, 30(2), 121–137.
26. Niemi, R. O., & Cabral, J. P. (2023). Building digital inclusion through structured learner support systems. Journal of Continuing Digital Learning, 16(1), 101–117.
27. Okoro, E. C., & Naledi, B. T. (2022). Employment status and digital access: Barriers in lifelong learning. Journal of Educational Transitions, 19(4), 107–122.
28. Sethi, A. P., & Venkatesh, D. R. (2023). Anxiety and avoidance in adult digital literacy learning. Journal of Psychological Studies in Education, 16(3), 121–135.
29. Sharma, M. B., & Kwan, C. Y. (2023). Psychological impact of digital incompetency on adult learners

in technical programs. Journal of Digital Learning Behaviors, 17(3), 88–103.

30. Singh, M. D., & Kaur, S. P. (2022). Socio-emotional challenges in digital technical education for adult learners. Distance Learning and Development Journal, 28(4), 183–198.

31. Turner, B. J., & Cheng, D. S. (2023). Global trends in pre-course digital training: Preparing adults for online learning. Open Learning and Skills Journal, 19(3), 154–170.

32. Watanabe, K. T., & Solis, D. M. (2022). Online technical programs and the digital skills divide: An evaluation of adult learning outcomes. Journal of Educational Access and Equity, 16(3), 158–172.

33. Yang, Q. T., & Bell, S. M. (2022). Enhancing critical thinking through digital tools in online technical courses. Journal of Lifelong Digital Learning, 19(1), 103–119.

34. Zhu, L. Y., & Morales, H. B. (2023). Joint effects of psychological and socioeconomic factors in digital learning retention. Journal of Digital Literacy and Adult Learning, 25(2), 144–158.