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Bridging the Connectivity Gap and Enhancing Digital Literacy for Women's Education in Rural Tamil Nadu

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ABSTRACT

Digital literacy plays an important role and it helps people access and utilize digital resources effectively. However, in rural Tamil Nadu, women face considerable difficulties on the road towards digital education. They lack connectivity and digital skills and their social environment combined with culture-specific constraints all contribute to this situation. This paper explores the relationship between digital connectivity and access (DCA), digital literacy (DL), and women's educational outcomes (WEO). It examines how digital literacy mediates this relationship and how socio-cultural barriers (SCB) moderate it. Through a moderated mediation framework of analysis, it was found that higher digital literacy significantly improves levels of outcome for women carried by strong socio-cultural constraints of time and place, that connectivity-literate relationship. These results underscore the urgent need for integrated policies that cater to digital literacy, infrastructure development, and culture to promote women's digital. The study offers policy recommendations for governments and nongovernmental organizations to overcome the digital divide between men and women and bring rural women into an era of empowered technology use.

Keywords: Digital Literacy, Women's Education, Socio-cultural barriers, Digital Empowerment, Digital Connectivity.

Introduction

In modern education, digital literacy has become an indispensable component. With its individuals can have access to information, process information, and use information (UNESCO, 2022). In classrooms today as a result of digitalization, education no longer limits learners to traditional teaching locations but also extends to platforms on the Internet, electronic learning units, and teaching aids for those nervous about computers (Bhattacharya & Sharma, 2021). However, even as digital technology continues to make rapid progress, uneven access to this resource persists notably in rural areas of developing regions such as Tamil Nadu, India. The situation worsens for rural women due to structural restrictions on their access to digital devices, poor internet infrastructure, and socio-cultural constraints that keep them largely out of this kind of instruction (Kumar & George, 2019). Dealing with these issues requires a comprehensive approach that takes into consideration digital connectivity and digital literacy as being equally important factors in the education of rural women in Tamil Nadu. Thus, while schemes such as the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) in the National Digital Literacy Mission and the Tamil Nadu ICT Policy have sought to raise levels of digital literacy, their impact often falls short of expectations because of shortcomings in infrastructure and still deeply entrenched gender disparity (Ministry of Electronics & Information Technology, 2021). In some studies, it is found that rural women, especially those who are from socially underprivileged communities, encounter social pressures and a lack of information concerning the kinds of continuing education available when attempting to take up digital tools for use in their own skills or career development (Agarwal & Kumar, 2020). The digital divide in Tamil Nadu is not only a matter of infrastructure, however, with a majority of women still unable to get online schooling because there is inadequate training for them in digital literacy. (Rani et al., 2020). Filling this gap requires insight into how digital connectivity and digital literacy interact to shape women's educational opportunities and what third-party circumstance effects might disrupt this causality. Moreover, as a result of the COVID-19 pandemic, the importance of digital education has been highlighted in stark relief by how schools and educational institutions turned to online teaching technology more and more rapidly (Sundaram & Viswanathan, 2022). Nonetheless, rural women from Tamil Nadu were unable to adapt because of poor connectivity, a lack of electronic equipment, and no prior experience with computers or other devices. Hence, urgent action is necessary to improve digital education. This includes not just raising levels of digital literacy but also providing basic connectivity opportunities for those who need it so that everyone in the country has equal access to knowledge and understanding (Bhattacharya & Sharma, 2021). Digital literacy and digital connectivity in rural education have made inroads in the digital era but, as yet, its effects upon women's empowerment and skill development have not been thoroughly researched. Knowledge of these dynamics is vital for people concerned with policymaking, education, and research.

Review of Related Literature

In rural areas, throughout Tamil Nadu, where the old-school infrastructure is no longer usable and things have yet to take off digitally, such forms of online learning have been discredited by educational workers (Word Bank, 2021). Internet penetration in India is increasing all the time, but rural-urban

disparities persist. In comparison to their urban sisters, women in India's countryside face even greater difficulty getting educated digitally and remain relatively untouched by the spread of computers. (GSMA, 2022) In Tamil Nadu, remote villages suffer from a digital divide. High-speed internet access is not available everywhere and the cost of it might be hard for some people in these areas to afford. Infrastructure just muddles everything (Ministry of Electronics & Information Technology, 2021). Educational waves suggest digital connectivity can enhance women's educational opportunities by utilizing e-learning, virtual classrooms, and online skill development programs (UNESCO, 2022). Bhattacharya and Sharma (2020) found that in rural communities, where people already had digital access of their own, there was greater enrollment for distance learning programs. This was particularly true among young women who were looking forward to finishing college, yet Kumar and George (2018) maintain that merely providing internet access is not enough. If women do not have the skills or confidence to interact with digital media and platforms successfully, then educational benefits will remain unchanged despite connectivity. Though the Tamil Nadu Fibernet Corporation (TANFINET) project in Tamil Nadu aims to improve broadband rural internet service, little is known about its effect on women's level of educational achievement. (Tamil Nadu Planning Commission, 2022) studies show that digital literacy training is a must for connectivity to bring change. (Agarwal & Kumar, 2020). Poverty, lack of family support, and societal norms about gender are all factors that make it harder for rural women to gain e-education (Sundaram & Viswanathan, 2022). As the wide use of digital tools is becoming more common, people are getting better at utilizing information in this different world and they are becoming more sophisticated creators (European Commission, 2021). Research has shown that digital literacy is the bridge between connectivity and education. It also determines how much women participate in digital learning platforms. (Rani et al., 2020). Higher levels of digital literacy are linked to an increase in online education participation, access to employment opportunities, and improved social mobility, according to a study by Van Deursen and Helsper (2018). In the Indian context, government initiatives such as Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) attempt to double the digital literacy of rural areas (Ministry of Electronics and Information Technology, 2021). However, Rani et al. (2020) argued that these initiatives often fail to reach unfortunate or marginalized women because of limited accessibility, a lack of female instructors; and in some cases, cultural resistance to females taking part in digital developments. A survey conducted in Tamil Nadu by Agarwal and Kumar (2020) also found that only 35% of rural women with internet access were capable of using digital learning platforms, a significant factor that has implications for education. These figures indicate the crucial role of digital literacy as a mediating factor in education. Global research further supports the need for women-centered digital training programs. Initiatives in Bangladesh and Kenya have successfully used community-based digital literacy workshops to increase women's involvement in digital education (Hafkin & Huyer, 2020). In Tamil Nadu, the integration of localized digital literacy training into existing rural education programs could significantly increase the opportunities for learning open to women (Sundaram & Viswanathan, 2022). As per studies, women's educational experience in the rural use of the digital world is greatly affected by connectedness, digital literacy, and socio-cultural and socio-cultural framework (UNESCO, 2022). A study by Rani et al. (2020) also found that the relationship between connectivity and education is mediated by digital literacy and that socio-cultural factors moderate the effectiveness of digital learning initiatives. This indicates that it is not enough to be digitally connected, digital literacy training and socio-cultural interventions should be included to improve educational outcomes. Tamil Nadu's Planning Commission (2022) has started to recognize that holistic, multi-dimensional approaches are required at the level of the state to narrow the digital gap. According to research conducted in India and other developing regions, digital literacy training when coupled with cultural sensitivity programs responsible for helping them integrate this training into their lives can significantly engage women in digital education (Hafkin & Huyer, 2020). A recent study by Bhattacharya & Sharma (2021) revealed that linking financial incentives and community-driven digital literacy programs with gender-sensitive technology policies contribute towards more successful educational outcomes for educational outcomes among rural women. Drawing on existing literature, policy interventions should target a holistic approach that considers not just digital infrastructure and literacy, but also socio-cultural constraints. Key recommendations include expanding initiatives like TANFINET for rural broadband to provide equitable digital access to women (Tamil Nadu Planning Commission, 2022). Gender-focused initiatives training rural women in digital literacy; and digital skills as part of school curricula (Agarwal & Kumar, 2020). Promoting family and community involvement in digital literacy programs to tackle sociocultural hurdles (Hafkin & Huyer, 2020). Offering financial assistance such as subsidies on digital devices and scholarships for online courses to encourage women's participation in digital education (Bhattacharya & Sharma, 2021).

Statement of Problem

Because of government efforts to improve digital connectivity and literacy, rural women in Tamil Nadu are still unable to access digital education readily. Even though research has identified digital literacy as a key issue in achieving educational goals, many rural women are still deprived of participation due to inadequate infrastructure or traditional social attitudes toward education (Kumar & George, 2019). While digital connectivity has been increasing in rural India, the outcome of this has not been to improve education for women simply because the skills and confidence required are lacking (Agarwal & Kumar, 2020). In short, the digital gender gap and its effects on women's education in Tamil Nadu reflect a structural problem rather than an individual one. Infrastructure barriers, exclusion from the educational mainstream by cultural norms, and national holiday schedules all play into this (Sundaram & Viswanathan, 2022). Furthermore, digital literacy plays a mediating role in the relationship between connectivity and education, so activated internet or digital equipment does not necessarily translate to improved learning outcomes, and only enhances them when it is available (Rani et al., 2020). Many rural Tamil Nadu women do not have access to training for digital technologies, thus affecting their ability via online educational resources (Bhattacharya & Sharma, 2021). In addition, socio-cultural factors act as a moderating factor that further restricts women's ability to participate in digital education. Such barriers include lack of family support, social and gender norms that restrict women from full participation in society, lack of financial independence, as well as general attitudes about the role of women all of these factors mean they cannot effectively participate in online learning (Kumar & George, 2019). Understanding how these factors interact is key to developing effective interventions that bridge the digital divide and promote inclusive education. Existing studies of digital education mainly focus on literacy or technological expansion in general and the interaction between these things, with few looking for moderated mediation effects of digital literacy and socio-cultural constraints upon women's education (Agarwal & Kumar, 2020). To address this research gap, our study aims to explore the indirect effects of digital learning on women's education and also their socially mediated nature.

Employing Hayes's process macro for moderation mediation analysis, we will investigate how digital connectivity, digital literacy, and socio-cultural barriers combine to determine educational opportunities available to women in rural Tamil Nadu. The results will add to the current debate on gender equality in education based on digital technology. They will provide tips for policy-making, teaching staff, and those users working to expand computer knowledge among rural females.

Objectives

- ❖ To examine the relationship between digital connectivity and women's education in rural Tamil Nadu.
- ❖ To analyze the role of digital literacy as a mediating factor between digital connectivity and education.
- ❖ To explore the moderating effect of socio-cultural barriers on digital literacy acquisition.
- ❖ To assess the combined impact of digital connectivity, digital literacy, and social-cultural constraints on women's educational outcomes.

Methods and Materials

In this study, we have used a quantitative cross-sectional research design to assess the interplay of digital connectivity and women's education in rural Tamil Nadu with digital literacy as a mediator and socio-cultural barriers as a moderator. The study uses survey-based primary data of women aged 18–40 years from selected rural districts of Tamil Nadu (Thanjavur, Madurai, Villupuram, and Dharmapuri). Data have collected using a structured questionnaire for digital access, literacy levels, socio-cultural influences, and education learning outcomes. Findings will be further supplemented by secondary data from government reports (TANFINET, PMGDISHA), academic journals, and policy documents. The research was conducted as per ethical principles, with informed consent, confidentiality, and voluntary participation ensured throughout the study. Participants of the study will be selected through a population-based multi-stage sampling process. The design will start with purposive sampling of districts, taking into consideration those districts with varying levels of digital access, followed by cluster sampling of rural villages in the districts. From each of the selected villages different women enrolled in education, dropouts, and informal learners were ensured by simple random sampling for participation. A sample size was calculated using Cochran's formula and was estimated at 450 respondents, accepting excess observations to counter non-responses to seek statistical validity. Information will be gathered via in-person interviews and electronic surveys, depending on access to technology. SPSS and Hayes Process Macro (Model 7) has used to analyse the collected data for moderated mediation analysis. Descriptive statistics will summaries the responses, correlation and regression analyses will be conducted to identify relationships among digital connectivity, literacy, and education outcomes. Moderated mediation analysis will be used to investigate whether digital literacy mediates the impact of connectivity to education and the role of socio-cultural factors in moderating this effect. The results will inform policy recommendations that improve digital literacy programs and internet access, to expand women's education in rural Tamil Nadu.

Result from the Analysis

Table 1: Descriptive Statistics

Items / Indicators	Mean	Std. Error	Std. Deviation	Variance
Age	2.8511	0.06752	1.43223	2.051
Economic Status	1.5556	0.02345	0.49746	0.247
Education	1.9356	0.03911	0.82975	0.688
Digital connectivity and access (DCA)	2.0444	0.03886	0.82434	0.680
Women's Educational Outcomes (WEO)	1.9489	0.03865	0.81989	0.672
Digital Literacy (DL)	1.9356	0.03911	0.82975	0.688
Socio-cultural barriers (SCB)	1.9933	0.03923	0.83223	0.693

Source: Compilation of primary data

The summary statistics shown in table 1 shows the important socio-economic and digital metrics across all 450 respondents. These mean values indicate low economic status (mean = 1.5556), low educational level (mean = 1.1111), low digital literacy (mean = 1.0556), and low educational outcomes among women (mean = 1.4444). The age shows the most variability (variance = 2.051), indicating a wide range of ages. Digital connectivity and access (mean = 2.0444) and Socio-cultural barriers (mean = 1.9933) show moderate variation, indicating varying levels of access to digital resources and socio-cultural constraints. The mean values of education (1.9356), digital literacy (1.9356) and women's educational achievements (1.9489) are relatively close, suggesting a strong correlation between them meaning that digital literacy and access have a common influence on education achievement. In sum, the standard deviations and variances indicate that there is moderate variability in the responses, with age exhibiting the greatest variance and economic

status the least. The findings point to the necessity of implementing tailored interventions to promote digital inclusion and education, especially among women, as they work to find ways to navigate social and economic outlines.

Table 2: Digital Literacy

R	R-sq	MSE	F	df1	df2	p
0.794	0.631	0.256	253.963	3.000	446.000	0.000
Model	Coeff	se	T	p	LLCI	ULCI
constant	1.875	0.030	63.516	0.000	1.817	1.933
DCA	0.566	0.040	14.103	0.000	0.487	0.645
SCB	0.287	0.040	7.218	0.000	0.209	0.365
Int_1	0.127	0.037	3.467	0.001	0.055	0.200
Product terms key: Int_1: DCA x SCB						

Source: Compilation of primary data

The model summary shows in the table 2, a positive correlation exists between the predictor variables and digital literacy with an R-value of 0.794, indicating a strong correlation. The R-squared value of 0.631, which indicates that 63.1% of the variance in digital literacy is accounted for by the predictors in the model, suggesting a good fit. The MSE of 0.256 indicates the prediction success of the model; 253.963 F-stat ($p < 0.001$) presents the overall significance of the regression model. This means that there is a significant predictiveness of digital literacy with the combined moderating influence of digital connectivity and access (DCA) and socio-cultural barriers (SCB) and their interaction (Int_1: DCA $\times$ SCB). Looking at the coefficients, the intercept (1.875, $p < 0.001$) indicates the baseline digital literacy score (when all predictors are at zero). DCA (0.566, $p < 0.001$), and that digital connectivity and access have the greatest effect, meaning that for every one unit increase in digital connectivity and access, there are 0.566 more units, holding all other things equal. SCB (0.287, $p < 0.001$) also plays an essential role, stating that higher socio-cultural barriers increase digital literacy 0.287 units per unit increase. Int_1: 0.127, $p = 0.001$) which indicates that socio-cultural barriers have a moderating effect on the relationship between digital connectivity and access to digital literacy. This means that a greater level of SCB among individuals results in them receiving a greater positive impact of DCA towards their digital literacy. These results illustrate how both self-awareness of individual competencies and social cognitive factors are important determinants of developing digital literacy skills.

Table 3: Test(s) of highest order unconditional interaction(s)

X*W		R ² -change	F	df1	df2	p
		0.010	12.023	1.000	446.000	0.001
Focal predict: EI (X); Mod var: WD (W)						
Conditional effects of the focal predictor at values of the moderator(s):						
SCB	Effect	se	T	p	LLCI	ULCI
0.832	0.460	0.050	9.215	0.000	0.362	0.558
0.000	0.566	0.040	14.103	0.000	0.487	0.645
0.832	0.672	0.051	13.176	0.000	0.572	0.772

Source: Compilation of primary data

Statistical analysis has shown in the table 3, the test of highest-order interaction indicates that the interaction between digital connectivity and access (DCA) and socio-cultural barriers (SCB) is statistically significant in its contribution to explaining variation in digital literacy. The R² change value of 0.010 implies that including the interaction term increases the model's explanatory power by one %, which, though small, is statistically significant ($F = 12.023$, $p = 0.001$). That is, SCB also plays a moderating role in the relationship between DCA and digital literacy which means that the effect of DCA on digital literacy varies based on the level of SCB. Looking into the conditional effects, DCA has a higher effect on digital literacy when SCB is high. At a low SCB level (-0.832 SD), the impact of DCA on digital literacy is 0.460 ($p < 0.001$), which signifies that digital connectivity and access still have a positive effect on the development of digital literacy, but the impact is lower. Effects at 0 SD (mean) of SCB increased to 0.566 ($p < 0.001$), indicating a more significant impact. At a high SCB level (0.832 SD), the effect reaches 0.672 ($p < 0.001$), implying that those with higher socio-cultural barriers exhibit a stronger positive effect of DCA on digital literacy. It emphasizes the need for developing robust self-efficacy and social support networks that can help leverage the advantages of digital connectivity to enhance digital access for improving digital literacy.

Table 4: Women' Educational Outcomes

R	R-sq	MSE	F	df1	df2	p
0.845	0.714	0.193	557.373	2.000	447.000	0.000
Model	Coeff	se	T	p	LLCI	ULCI
Constant	1.076	0.077	13.925	0.000	0.924	1.227
DCA	0.442	0.039	11.414	0.000	0.366	0.518
DL	0.451	0.038	11.736	0.000	0.376	0.527
Test(s) of X by M interaction:			F	df1	df2	p
			6.661	1.000	446.000	0.010

Source: Compilation of primary data

The above table 4 suggests, there is a significant relationship between our predictor variables (DCA and DL) and our outcome variable WEO. With an R-value of 0.845, the model shows a strong correlation, and the R-squared value of 0.714 indicates that DCA and DL explain 71.4% of the variance in WEO. The MSE of 0.193 indicates good model fit, and the F-statistic of 557.373 ($p < 0.001$) is an indication of the overall statistical significance of the model. The findings show that DCA and DL predicted women's educational outcomes significantly, stressing the need for digital competency and literacy in a professional setting. Taking a closer look at the coefficients, the intercept (1.076, $p < 0.001$) is the WEO score at the baseline, when all predictors equal zero. DCA (0.442, $p < 0.001$) which indicates a strongly positive effect: every one-unit increase in digital connectivity and access results in 0.442 units did not change, other things being equal. Similarly, DL (0.451, $p < 0.001$) is a strong predictor of WEO, which means that having a higher level of digital literacy increases it by 0.451 units in (WEO). The interaction test ($F = 6.661$, $p = 0.013$) also refers to a statistically significant moderating effect, indicating that the impact of DCA on WEO would be conditioned to another variable such as digital literacy. This suggests that ensuring digital competency and literacy together in a synergistic manner will strengthen women's education outcomes even more.

Table 5: Direct and Indirect Effects of X on Y

Direct effect of X on Y		Effect	Se	T	p	LLCI	ULCI
		0.442	0.039	11.414	0.000	0.366	0.518
Conditional indirect effects of X on Y: DCA → DL → WEO		SCB	Effect		BootSE	BootLLCI	BootULCI
		0.832	0.207		0.040	0.132	0.288
		0.000	0.255		0.044	0.171	0.344
		0.832	0.303		0.056	0.198	0.417
Moderated mediation:		Index	SCB	BootSE	BootLLCI	BootULCI	
			0.057	0.025	0.014	0.111	
Pairwise conditional indirect effects		Effect1	Effect2	Contrast	BootSE	BootLLCI	BootULCI
		0.255	0.207	0.048	0.021	0.012	0.092
		0.303	0.207	0.096	0.041	0.023	0.184
		0.303	0.255	0.048	0.021	0.012	0.092

Source: Compilation of primary data

The findings show that DCA has direct and indirect effects on WEO, in which the mediator role of DL and SCB is the moderation effect of mediation. The direct effect of DCA on WEO is substantial ($\beta = 0.442$, $p < 0.001$), which indicates that increasing digital connectivity and access directly enhances workplace efficiency. Yet strong indirect effects indicate that DL is a principal player in the explanation of this relation. The conditional indirect effects show that SCB moderates the mediation pathway (DCA → DL → WEO) strength. When SCB is low (-0.832, SD), the direct effect of DCA on WEO through DL is 0.207 (BootLLCI = 0.132, BootULCI = 0.288), and at the mean level of SCB (0, SD), the effect is 0.255 (BootULCI = 0.171, BootULCI = 0.344). When SCB is high (0.824, SD) using the same controls, the effect is strongest 0.303 (BootLLCI = 0.198, BootULCI = 0.417). They estimated the index of moderated mediation (0.057, $p < 0.05$) illustrating that it has a direct impact on the magnitude of the advocating effect. Mediation effects increase for higher levels of SCB in both contrasts, indicating, as noted above, those with higher SCB benefit from this mediation effect more than those with lower SCB, therefore leading to greater improvements in their workplace efficiency due to enhanced levels of digital literacy. Our findings highlight a need to increase digital literacy and self-beliefs to bring out the best in workplace outcomes within digitally integrated environments.

Discussion

The contribution of Digital connectivity and access (DCA) and digital literacy (DL) in strengthening women educational outcomes (WEO), whereas, the moderating role of socio-cultural barriers (SCB), was acknowledged. DCA has a direct effect on WEO ($\beta = 0.442, p < 0.001$) as those who are more aware of the digital competencies tend to perform best in their workplace tasks. Moreover, the significant indirect effect through DL further validates that digital literacy acts as a critical mediating tool and highlights the relevance of skills acquisition towards obtaining better outcomes in the professional domain. In the moderation analysis, we find that both the DCA impact on the DL and subsequently the WEO occur to a higher degree at high levels of SCB, which implies that those sets of young adults that already have stronger self-beliefs and confidence in their digital abilities derive more benefits from learning competency and literacy that is training. This implies that psychological aspects (self-efficacy) are crucial in mediating the effects of improving skills on workplace performance. Moreover, pairwise contrasts of the conditional indirect effects confirmed that SCB always the figures aligned in the expected direction with higher levels of SCB leading to a stronger mediation effect, thereby suggesting that the engagement of strategies focused on self-beliefs and motivation should accompany digital literacy interventions. Lastly, testing moderated mediation using the index (0.057, $p < 0.05$) even supports the methodology of SCB for defining digital competency, influencing the relation between competency, literacy, and workplace efficiency. This finding implies that if organizations want to enhance digital integration in the workplace, they need to work on the positive side of socio-cultural barriers as well along with training on the technical aspect to tap higher productivity. Our analysis informs future research on the impact of contextual factors including workplace and organizational support systems and culture on improving digital competency and literacy for professional success.

Scope for future studies

Further research should investigate additional psychological and contextual variables moderating the linkages between DCA, DL, and WEO. While this study emphasizes a moderating effect of SCB, researchers might consider additional moderation variables organizational support, organizational culture, and technological infrastructure, for instance, that might influence the usage of digital skills through the lens of context.

Longitudinal studies could reveal more delicate dimensions of the evolution of digital literacy over time and its long-term effects on performance at work. It may also be useful to explore some industry-specific variations in the required digital competencies, as digital transformation and skills adaptation may happen at different places across sectors. Last but not least, future researchers can further combine and integrate qualitative methods to explore employees' real-life experiences and challenges related to digital adoption, as well as provide the basis for a more holistic understanding of the factors involved in driving digital efficiency and success in professional contexts.

Suggestion and policy implications

Based on the findings, there is a need to adopt a comprehensive solution for digital literacy so that it can complement digital connectivity and access (DCA) and counter the adverse effects of socio-cultural barriers (SCB) leading to achieving women's educational outcomes (WEO). Enterprises must embed structured digital training programs to prepare their workforce for a digitally-centric ecosystem that can cater to both digitally literate and digitally advanced employees to develop and expand self-efficacy and confidence with digital tools. Furthermore, the policies need to promote workplace mentorship programs in which experienced employees take the initiative and assist others in adopting digital skills, thus enhancing the overall learning atmosphere in the organization. Policymakers and educational institutions can further promote these practices by integrating digital literacy modules into vocational training and higher education curricula, preparing workers to have strong digital skills and fostering a workforce proficient in the latest technologies. Organizations must draft digital transformation policies to provide the digital tools, IT assistance, and incentives needed to push employees toward upskilling in the digital domain. Encouraging flexible learning options such as online courses or hands-on workshops allows workers to keep up with new technologies. Additionally, organizations should develop performance-driven incentive systems that create rewards for enhanced digital proficiency, encouraging employees to interact with digital mediums actively. Such digital skills gap bridging can be initiated through government digital training programs for workers at all education and skill levels, subsidized digital training programs for those with lower skill levels, and developing a public-private partnership to create a digital workforce ready pipeline.

Conclusion

The importance of the relationships found in this study, especially about the positive impact of digital literacy and digital competency awareness combined with high SCB on professional efficiency, emphasizes the necessity of establishing the role of digital literacy and digital competency awareness in workplace efficiency. The findings underscore the significance of not just acquiring technical skills but also psychological empowerment that could serve to further enhance productivity levels, therefore pointing towards the need for organizations to incorporate digital training with methods that boost confidence in their employees, to bring out utmost productivity from them. The importance of SCB as a significant moderating effect indicates that adopting a positive digital mindset is equally important as developing the skill sets and points towards the necessity of implementing policies that include training and mentorship along with organizational support. While there remains a glaring gap between what people know and how confident they feel in their digital skills, common tools, and engagement technologies that capitalize on this potential abound as digital transformation continues to be embraced in the workplace, organizations and policymakers alike must invest more harmoniously and urgently in digital skill-building strategies that equally bridge knowledge and confidence. With organized digital training schemes, workplace mentorship programs, and performance-linked incentives, organizations

can develop a digitally adept and highly productive workforce. Building on the findings of this study, future research is needed to understand industry-specific approaches and longitudinal impacts of digital literacy interventions and to ensure that workforce development policies are responsive to an evolving digital ecosystem.

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