

## EXPLORING GENDER DISPARITIES IN DIGITAL EQUITY AND ITS IMPACT ON TECHNO-LITERACY AMONG VOCATIONAL LEARNERS IN LARKANA, SINDH.

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### Abstract

The research aims to explore the problem of gender differences in digital equity and how they affect techno literacy among vocational students in Larkana, Sindh. It delves into the nature of how a fair entry to digital resources improves the technological proficiency of students and equips them to be active as skillful digital citizens in the twenty-first century. A mixed method research design was used based on sequential explanatory design. Quantitative data were gathered by survey of 96 vocational learners with the help of a structured survey and analyzed with the help of SPSS 23, and the qualitative data were gathered with the help of semi-structured interviews with 10 (5 male and 5 female) purposely selected participants and analyzed with the help of the thematic analysis. It shows that there is a positive association between digital equity and techno-literacy where the participants have reported that the availability of digital devices, good internet connection and use of appropriate educational software positively influenced learning activities, practical skills acquisition, and confidence in the use of technology. Male learners expressed relatively few obstacles to accessing digital materials, and female vocational learners mentioned limited access to personal devices, lack of access to internet, and reduced opportunities to practice using digital materials. The research highlights the need to make policy and institutional-level changes that narrow the gap between genders in digital use, divert resources and establish support systems that are inclusive of all to help lessen gender disparities in digital usage.

### 1.0- INTRODUCTION

Digital technology is in the twenty first century a basic source of education, employment, and socio-economic development. Being able to access and use digital outcomes commonly known as **techno-literacy** is becoming an even greater need, especially in vocational education where applied skills and familiarity with technology have a direct impact on employability and career

advancement. Although the importance of digital skills is widely recognized as an essential requirement of personal and professional growth, there is still a significant gap in access to technology and or digital learning opportunities, which can be frequently referred to as digital inequity.

The term digital equity describes the equitable

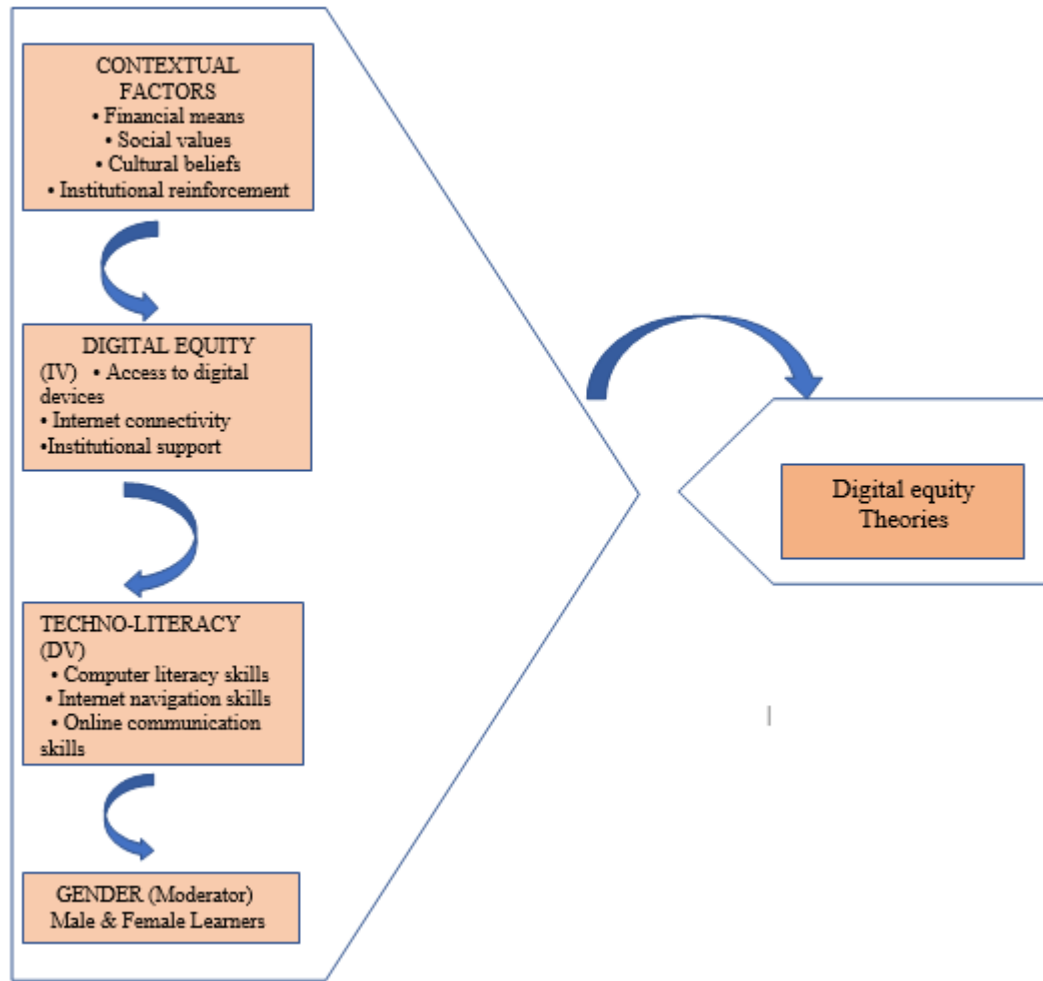
and comprehensive provision of technological products, consistent access to the internet, and the expertise needed to be able to operate the digital tools. During the formation of digital equity in many developing situations, such as in Pakistan, gender roles, socio-cultural norms, and economic factors are the most crucial factors to which digital equity is strongly influenced. Empirical studies have always shown that women and girls have had structural and social disproportionate disadvantages to digital access including; low financial capabilities, limited mobility, poor institutional support and the formal cultural expectations. As a result, digital inequalities rooted in gender prevent educational inequalities and limit even greater socio-economic empowerment of female learners (Hilbert, 2011; van Dijk, 2020).

One of the most important factors in the analysis of digital inequities is vocational education, which has a high focus on practical training and the use of technologies in the delivery of educational services. In the environment, where digital competence is a component of the skill development, gender disparity can have a substantial impact on the results of learning, technical confidence, and job preparation. A major district in Sindh, Larkana, suggests a very

timely background to this study. Despite the recent growth of vocational education programs in the region, the female learners still face significant problems in accessing digital resources, learning to use technology as an element of the learning process, and acquiring techno-literacy skills that would be equal to those of the male learners. Such issues are often made worse by social norms, parenting, a lack of institutional support and a poor digital infrastructure.

The analysis of the gender inequality in the digital equity in higher education is thus not just an academic task, but also a vital policy and development issue. Further insight into the scope, character and implications of these inequalities can be used to implement specific actions that will help to improve digital access, empower techno-literacy, and improve equal educational achievements. In this regard, this paper explores how gender, digital equity and techno-literacy are related to vocational learners in Larkana, Sindh, and how this understanding can be used to cultivate evidence-based information policy-makers, educators, and development practitioners aiming to alleviate the digital divide and create gender inclusive learning settings.

Fig. 1 Conceptual Framework of the Study



2.0- Conceptual Framework

The theories that have informed the conceptual framework of this study include digital divide and digital equity theories, which state that a prerequisite to the development of digital skills is that equitable access to digital resources must exist. The assumption made by the framework is that digital equity has a direct effect on techno-literacy, whereas gender conditions the relationship through the inequality of access, opportunities, and socio-cultural restrictions.

2.1- Framework Components

2.1.1- **Independent Variable (IV):** Digital Equity (To access digital equipment, internet connectivity, and institutional backup)

2.1.2- **Dependent Variable (DV):** Techno-Literacy (computer literacy skills, Internet

navigation and Internet communication skills).

2.1.3- **Moderating Variable:** Gender (vocational learners, male and female).

2.1.4- **Contextual Factors:** Financial means, social values, cultural beliefs and institutional reinforcement.

The model assumes that an increased degree of digital equity results into better techno-literacy but the degree to which this is so depends on gender because of aspects of contexts and structures. The framework made the operationalization of variables, data collection, analysis and interpretation (Miles et al., 2014).

3.0- Research Objectives:

The primary objectives of this research are:

1. To assess the level of digital equity (access to digital devices, internet, educational software)

among male and female vocational learners in Larkana, Sindh.

2. To explore the gender disparities in digital resource access and how these disparities impact the techno-literacy skills of vocational learners.

3. To evaluate the relationship between digital equity and the techno-literacy skills (e.g., proficiency in software, internet navigation, digital communication) of male and female learners in vocational education.

4. To identify barriers that contribute to gender disparities in digital equity among vocational learners in Larkana, Sindh.

#### 4.0- Research Questions

The research questions that will guide this study are:

1. What is the level of digital equity (access to devices, internet, and educational tools) among male and female vocational learners in Larkana, Sindh?

2. How do gender disparities in access to digital resources impact the techno-literacy skills of male and female vocational learners?

3. What specific gender-based challenges do female vocational learners face regarding access to digital tools and resources in Larkana?

4. What is the relationship between digital equity and the techno-literacy skills of male and female vocational learners in Larkana, Sindh?

#### 5.0- Hypothesis

##### 5.1- Hypothesis 1 (Digital Equity by Gender)

- **H<sub>01</sub> (Null Hypothesis):**

There is no significant difference in the level of digital equity (access to digital devices, internet, and educational software) between male and female vocational learners in Larkana, Sindh.

- **H<sub>11</sub> (Alternative Hypothesis):**

There is a significant difference in the level of digital equity between male and female vocational learners in Larkana, Sindh.

##### 5.2- Hypothesis 2 (Impact of Digital Equity on Techno-Literacy)

- **H<sub>02</sub> (Null Hypothesis):**

Digital equity has no significant impact on the

techno-literacy skills of vocational learners in Larkana, Sindh.

- **H<sub>12</sub> (Alternative Hypothesis):**

Digital equity has a significant positive impact on the techno-literacy skills of vocational learners in Larkana, Sindh.

##### 5.3- Hypothesis 3 (Gender as a Conditioning Factor)

- **H<sub>03</sub> (Null Hypothesis):**

Gender does not significantly influence the relationship between digital equity and techno-literacy among vocational learners in Larkana, Sindh.

- **H<sub>13</sub> (Alternative Hypothesis):**

Gender significantly influences the relationship between digital equity and techno-literacy among vocational learners in Larkana, Sindh.

##### 5.4- Hypothesis 4 (Barriers and Female Learners)

- **H<sub>04</sub> (Null Hypothesis):**

Gender-based barriers do not significantly affect female vocational learners' access to digital resources in Larkana, Sindh.

- **H<sub>14</sub> (Alternative Hypothesis):**

Gender-based barriers significantly affect female vocational learners' access to digital resources in Larkana, Sindh.

#### 6.0- Methodology

The research design that was adopted in this study was the mixed-methods research design, to research on gender disparities in digital equity and its impact on techno-literacy among vocational learners in Larkana, Sindh. The research objectives informed the research methodological decisions, which were informed by the existing methodological literature to attain rigor, validity and credibility.

##### 6.1- Philosophical Position (Research Paradigm)

This research is conducted based on a **pragmatist research paradigm**, which emphasizes the most effective method of research as the one that would serve the purpose of the research issue, but

not the unified adherence to a particular philosophical school (Creswell and Plano Clark, 2017).

### 6.1.1- Justification

The research issue, which is gender inequalities in digital equity and techno-literacy, needs both: Measured online access and skills, and

**Subjective investigation** of the experiences, perceptions, and gender-based obstacles of the learners.

Pragmatism advocates the combination of positivist assumptions, including quantifying the degrees of digital equity in terms of quantitative surveys, and interpretivism assumptions, including the realization of gendered experiences in terms of qualitative interviews and focus group discussions. This paradigm facilitates methodological pluralism and focuses on practical and context-specific solutions that are straight forward to vocational education and policy-making (Johnson et al., 2007).

### 6.2- Research Design

The mixed-methods design was implemented which combined quantitative and qualitative methods. The design is especially suitable when the research questions need both comparisons to be measured and contextual interpretation (Creswell & Plano Clark, 2017). Triangulation is achieved through the combination of various approaches and this adds to the validity, reliability and completeness of the results (Greene et al., 1989).

#### 6.2.1- Quantitative Phase

##### Research Design

The descriptive and comparative research design was used to test and compare the extent of digital equity and techno-literacy among male and female vocational learners. This type of design is appropriate to detect the existing conditions and compare the groups of people in a specific population (Bryman, 2016).

##### Population and Sampling

The quantitative sample consisted of 100 vocational learners; 50 men and 50 women that

were sampled in vocational institutions in Larkana, Sindh. In order to have equal representation of both genders, stratified random sampling was employed. This method is more representative and reduces sampling bias where the comparisons between subgroups are at the center of the research goals (Baltes and Ralph, 2020).

##### Instrumentation

An organized questionnaire that was used to measure digital equity, techno-literacy, and gender-based barriers was used in the collection of data. The questionnaire consisted of questions concerning the availability of digital devices, internet connection, educational software and digital communication tools. Formatted tools help to gather data in a standardized way and perform powerful statistical analysis (Shorten and Smith, 2017).

### 6.3- Data Collection Procedures

The surveys were conducted using questionnaires that were self-administered in the various vocational institutions that were selected. The participants were given proper guidelines, and sufficient time was given to the respondents so that they could be able to give proper responses that were accurate and thoughtful.

#### 6.3.1- Data Analysis

Distribution of quantitative data was done through SPSS-23. The levels of digital equity and techno-literacy were summarized with the help of descriptive statistics (means and standard deviations). Gender-based differences were studied with the help of independent-samples t-tests and Spearman correlation were applied to evaluate the connection between digital equity and techno-literacy. Such statistical methods are suitable to compare the means of groups and analyze the relationships between variables (Creswell and Creswell, 2018).

### 6.4- Qualitative Phase

#### 6.4.1- Research Design

The chosen research design was an exploratory qualitative study that was expected to provide

more information about the experience and perception of learners regarding digital equity and techno-literacy and especially gender-based obstacles. The qualitative inquiry is quite appropriate in explaining intricate social aspects that cannot be exhaustively described using only quantitative indicators (Creswell and Plano Clark, 2017).

**6.4.2- Sampling Strategy**

The survey participants were used to select a subsample purposefully of 5-8 male and 5-8 female vocational learners. The selection was grounded on the differences in the digital access and techno-literacy levels to secure the diversity of views. The use of purposive sampling is suitable when it is necessary to gain in-depth and rich information instead of statistical generalizability (Creswell & Plano Clark, 2017).

**6.4.3- Data Collection Methods**

Semi-structured interviews served as the means of collecting qualitative data. The semi-structured form was flexible so as to probe the experiences, perceptions, and recommendations of the participants.

**7.0- Data Analysis**

The thematic analysis was applied on qualitative data. Interview were systematically coded to find out recurring patterns and themes which covered gender gaps, access to digital, techno-literacy, and possible ways to improve the situation. Thematic analysis was applied to the qualitative data. The

interviews were systematically coded to identify recurring patterns and themes related to gender gaps, access to digital resources, techno-literacy, and potential strategies for improvement. The analysis followed the six-phase thematic analysis approach proposed by Braun and Clarke (2006), ensuring consistency in coding and transparency in the analytical procedures (Bazeley & Jackson, 2013).

**7.1- Combination of both Quantitative and Qualitative Data.**

The quantitative and qualitative phases were incorporated with the help of a triangulation approach. Quantitative findings were given in form of measurable trends and relationships whereas qualitative findings were the given contextual explanations and an insight into the lived experience of learners. This integrative approach enhanced interpretation and allowed gaining a complete picture of how gender inequalities in digital equity affect techno-literacy (Creswell and Plano Clark, 2017; Doyle et al., 2016).

**Table-1** results of the Kolmogorov-Smirnov test with Lilliefors correction and Shapiro-Wilk test results are that all the variables of the study (DE1-DE5, TL1-TL5 and BDAT1-BDAT5) are significantly not normally distributed. The significance of each variable under consideration are below 0.05 ( $p = .000$ ) and, therefore, the null hypothesis of normality is rejected.

**Table- Tests of Normality**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
1.1 I have access to a personal laptop or computer for my studies	.314	95	.000	.785	95	.000
1.2 I have reliable internet access for online learning and research	.247	95	.000	.786	95	.000

1.3 My vocational program provides me with digital learning resources (e.g., online platforms, e-books, software).	.302	95	.000	.832	95	.000
1.4 I have access to digital devices (e.g., tablets, smartphones) for educational purposes outside of class.	.355	95	.000	.772	95	.000
1.5 There are gender disparities in access to digital tools and resources in my vocational program (e.g., male students have more access to devices than female students).	.182	95	.000	.879	95	.000
2.1 I can use word processing software (e.g., Microsoft Word, Google Docs) for creating reports and assignments.	.312	95	.000	.829	95	.000
2.2 I am confident in using spreadsheet software (e.g., Microsoft Excel, Google Sheets) for data analysis and calculations.	.297	95	.000	.850	95	.000
2.3 I can navigate the internet efficiently to find relevant information for my studies.	.304	95	.000	.813	95	.000
2.4 I am comfortable using email and communication tools (e.g., Gmail, WhatsApp, Zoom) for academic and professional communication.	.314	95	.000	.815	95	.000
2.5 I can use specialized software related to my field of study (e.g., CAD for engineering, Photoshop for design).	.310	95	.000	.843	95	.000
3.1 Lack of affordable internet access is a major barrier for me in completing online assignments or research.	.213	95	.000	.859	95	.000

3.2 Limited availability of digital devices (e.g., computers, laptops) in my household or school is a barrier to my learning.	.204	95	.000	.898	95	.000
3.3 Gender-based stereotypes affect my participation in tech-related activities or subjects.	.173	95	.000	.915	95	.000
3.4 Cultural norms around technology use in my community restrict my access to digital tools for education.	.188	95	.000	.909	95	.000
3.5 Limited training or support in using digital tools hinders my ability to become proficient in using them for my studies.	.159	95	.000	.910	95	.000

a. Lilliefors Significance Correction

This indicates that none of the measured items have normal distribution of data. This non-normality is associated with the item level Likert-scale data especially with a sample size of 96; hence, the further analysis needs to take into account the application of composite scores, robust estimation, or non-parametric statistic where necessary.

Table 2 shows the reliability statistics of the

measurement instrument which shows that it has a high internal consistency. The value of Alpha of 0.872, which is more than the generally acceptable of 0.70, proves that the scale is research firm. Likewise, the Cronbach Alpha value of standardized items (0.874) is nearly similar which indicates that the variances of the items are consistent and standardization does not have a significant impact on the reliability.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.872	0.874	15

Having 15 items in the scale, these findings can be considered valid in the view that the items have been quantifying the same underlying construct in a consistent and reliable way, which will mean that the instrument is now fit to undergo further statistical analysis and to model estimation.

As indicated in Table-3.1, the results indicate that 96 valid observations were received on the five items (DE1-DE5) which represented all the missing data. Each variable is ranging between 1 and 5 which proves that the responses are within the stated Likert-scale range and substantiates data validity.

	N	Minimum	Maximum	Mean	Std. Deviation
1.1 I have access to a personal laptop or computer for my studies	96	1	5	3.52	1.501
1.2 I have reliable internet access for online learning and research	96	1	5	2.82	1.723
1.3 My vocational program provides me with digital learning resources (e.g., online platforms, e-books, software).	96	1	5	3.49	1.281
1.4 I have access to digital devices (e.g., tablets, smartphones) for educational purposes outside of class.	96	1	5	3.52	1.392
1.5 There are gender disparities in access to digital tools and resources in my vocational program (e.g., male students have more access to devices than female students).	96	1	5	2.84	1.379
Valid N (listwise)	96				

The average is between 2.82 and 3.52, which indicates that on the average, respondents agree with the statements moderately, and the differences in agreement are relatively high with DE1 and DE4 (Mean = 3.52) and relatively low with DE2 and DE5. The standard deviations (between 1.281 and 1.723) suggest that there is a moderate distribution of the responses, which does not show an extreme consensus in the respondents or polarization of the perceptions of the respondents. All in all, these statistics are adequate to prove that the data are properly

spread within the measurement scale and can further be used in an inferential analysis.

According to **Table-3.2**, valid responses to all the five items (DE1-DE5) were used in measuring them, and no data was omitted, which was complete and reliable. All items have a minimum and a maximum of 1 and 5 respectively, and this demonstrates that the respondents employed the full Likert-scale range and that there are no out-of-range values in the data, which is an argument in favor of data validity.

	N	Minimum	Maximum	Mean	Std. Deviation
2.1 I can use word processing software (e.g., Microsoft Word, Google Docs) for creating reports and assignments.	312	95	.000	.829	95
2.2 I am confident in using spreadsheet software (e.g., Microsoft Excel, Google Sheets) for data analysis and calculations.	96	1	5	3.43	1.296
2.3 I can navigate the internet efficiently to find relevant information for my studies.	96	1	5	3.71	1.213

2.4 I am comfortable using email and communication tools (e.g., Gmail, WhatsApp, Zoom) for academic and professional communication.	96	1	5	3.66	1.296
2.5 I can use specialized software related to my field of study (e.g., CAD for engineering, Photoshop for design).	96	1	5	3.30	1.307
Valid N (listwise)	96				

The average is between 2.82 and 3.52, which indicates that on the average, respondents agree with the statements moderately, and the differences in agreement are relatively high with DE1 and DE4 (Mean = 3.52) and relatively low with DE2 and DE5. The standard deviations (between 1.281 and 1.723) suggest that there is a moderate distribution of the responses, which does not show an extreme consensus in the respondents or polarization of the perceptions of the respondents. All in all, these statistics are adequate to prove that the data are properly

spread within the measurement scale and can further be used in an inferential analysis.

**Table-3.3** reveals that all BDAT items (BDAT1-BDAT5) were measured using 96 valid responses, with no missing data, indicating completeness and consistency of the dataset. The minimum and maximum values for all items range from 1 to 5, confirming that respondents utilized the full Likert-scale range and that the data are free from out-of-scale values, thereby supporting data validity.

	N	Minimum	Maximum	Mean	Std. Deviation
3.1 Lack of affordable internet access is a major barrier for me in completing online assignments or research.	96	1	5	3.46	1.406
3.2 Limited availability of digital devices (e.g., computers, laptops) in my household or school is a barrier to my learning.	96	1	5	3.03	1.277
3.3 Gender-based stereotypes affect my participation in tech-related activities or subjects.	96	1	5	3.07	1.117
3.4 Cultural norms around technology use in my community restrict my access to digital tools for education.	96	1	5	2.97	1.174
3.5 Limited training or support in using digital tools hinders my ability to become proficient in using them for my studies.	96	1	5	3.04	1.281
Valid N (listwise)	96				

The mean scores (between 2.97 and 3.46) indicate the average degree of agreement between the respondents with BDAT1 having relatively higher levels of agreement and BDAT4 having slightly lower levels of agreement. Standard deviations, which are between 1.117 and 1.406, show that there is moderate variation within the

responses, hence different but reasonable variations in the perceptions of the respondents. All these findings justify the fact that the BDAT data are properly distributed, has an appropriate variability and can be used further in inferential and multivariate analyses.

The results of the group statistics are presented in

the **Table-4** that compares male and female respondents (N = 48 each) on three constructs, thus showing the presence of balanced sample, which could be compared gender-wise. To achieve digital equity, the mean score (Mean =

3.42, SD = 1.13) of males is greater than that of females (Mean = 3.06, SD = 1.08), indicating that the level of digital equity is perceived as comparatively higher among the male respondents.

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Digital equity	Male	48	3.4167	1.13049	.16317
	Female	48	3.0625	1.08307	.15633
Techno-literacy	Male	48	3.5708	1.14853	.16578
	Female	48	3.4833	1.07966	.15584
Barriers digital access	Male	48	3.0208	.86957	.12551
	Female	48	3.2083	.98496	.14217

Concerning technological literacy, males (Mean = 3.57, SD = 1.15) slightly outscore females (Mean = 3.48, SD = 1.08), which means that the general level of technological literacy is not much different except that males have an advantage. On the other hand, in case of barriers to digital access, the mean of females (Mean = 3.21, SD = 0.98) is higher than the mean of males (Mean = 3.02, SD = 0.87), which means that there are more significant barriers to digital access among female respondents. The similar standard deviations between genders imply that the responses were similar in their variability, whereas the small standard errors of the mean that the estimates of the means are stable and consistent. Altogether, these descriptive results are sufficient to assert the existence of observable gender-based differences, but an inferential analysis (say, an independent-samples t-test) is needed to establish whether these differences are found to be statistically significant.

**Independent Samples Test:** The findings reached as per the independent sample test are discussed in Table-4. Digital Equity: The independent samples t-test of the outcome of the digital equity show that no significant difference exists between the two groups. The test of equality of variances was not significant ( F = 0.362, p = 0.549) which indicates that the assumption of equality of variance was satisfied. The t-test revealed there was the mean difference of 0.35417 though not

significant ( t = 1.567, df = 94, p = 0.120). In addition, the 95 percent confidence interval of the difference included the value of zero, which is -0.09451 to 0.80284. This substantiates the fact that there is a similarity between the digital equity of the two groups.

**Techno-literacy:** In the same way, the scores in techno-literacy did not show any notable difference between the groups. The test of equal variances by Levene showed that there was no significance ( F = 0.005, p = 0.943) and the t-test did not show any significance ( t = 0.385, df = 94, p = 0.701) with a mean difference of 0.08750. The 95 percent interval (-.36425 to .53925) had zero, which substantiated the fact that there is no significant difference in techno-literacy in the groups.

**Barriers to Digital Access:** The discussion of barriers to digital access also did not indicate statistic significance. The test of equal variances conducted by Levene enabled the use of t-test, and the mean difference of -0.187500 was not significant ( t = -0.989, df = 94, p = 0.325). The confidence interval of -0.56404 to 0.18904 was 95 percent and contained the zero value, which implied that there is no significant difference in the level of impediments to digital access between the two groups.

General results suggest that both groups are not significantly different in digital equity, techno-

literacy or digital access barriers. The conditions were all met in the t-test and the non-significant p-values and confidence interval indicate that

there are similar conditions across the groups in these dimensions.

4. Independent Samples Test											
		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
										Lower	Upper
DIGITALEQUI TY	Equal variances assumed	.362	.549	1.567	94	.120	.35417	.22597	-.09451	.80284	
	Equal variances not assumed			1.567	93.828	.120	.35417	.22597	-.09452	.80285	
Technoliteracy	Equal variances assumed	.005	.943	.385	94	.701	.08750	.22752	-.36425	.53925	
	Equal variances not assumed			.385	93.643	.701	.08750	.22752	-.36427	.53927	
Barriarsdigitalacc esst	Equal variances assumed	1.624	.206	-.989	94	.325	-.18750	.18964	-.56404	.18904	
	Equal variances not assumed			-.989	92.577	.325	-.18750	.18964	-.56412	.18912	

8.0- Discussion:

8.1- **Online Merit between Male and Female Vocational Students:** The results of this paper show that in Larkana, Sindh both men and women pursue vocational courses they enjoy moderate digital equity especially with regard to access to digital technology, connectivity to the internet, and e-learning tools. The institutional structures, like joint computer laboratories and training workshops developed as one of the most important equalizing mechanisms due to which the learners of both sexes could get the baseline digital access. This is in line with the current evidence in Pakistan, which proposes that institutional provisions can be the key source of digital access among students with some marginalized and resource deprived background (Asad & Nazir, 2025).

Nevertheless, the findings also show that access in institutes does not necessarily reflect on a one-to-one digital equity, particularly among women learners. Women students complained of poor personal possession of the digital equipment and

the inability to access it outside of school. This institutional and personal distinction in digital equity is paramount and reflects earlier research on the point that access is not made without also having familiarity with using the digital tools, where learners have the ability to use tools independently and regularly (van Dijk, 2020). The current evidence supports the arguments that have been put forward by Asad (2025) that digital equity should be seen as meaningful access, and this means availability, autonomy, and continued use.

8.2- **Gender Digital differences and implications on Techno-Literacy:** The research also found that there were differences between access to digital resources based on genders, which was an indirect influence on the formation of techno-literacy. Male pupils had generally less socio-cultural and mobility-based limitations and were able to interact more often with digital technologies. Conversely, female students were

exposed to more complex hindrances that were founded on the basis of social-cultural beliefs, financial constraints, and limited movement, which limited chances to practice routinely and have an experiential learning.

These are aligned with the South Asian and Pakistani literature on women being digitally part in the mediation of household rules and economic dependence despite the institutional access being formally accessible. Asad and Nazir (2025) also emphasize the fact that marginalized learners, specifically socioeconomically disadvantaged ones are people who face financial and infrastructural limitations impeding the constant use of digital devices. The current research takes this fact a step further, showing that the mentioned limitations have a more significant negative impact on the female vocational learners, thus restricting the process of acquiring the applied techno-literacy skills, which depend on the constant application of the hands-on skills.

**8.3- Correlation among Digital Equity, Techno-Literacy:** The relationships between digital equity and techno-literacy and vocational learners indicated a significant and positive relationship through inferential analysis. Higher the access to the digital equipment, dependable internet and the educational programs, the higher the level of the skills in the navigation of the internet, software use and digital communication. This evidence empirically substantiates the main premises of the theory of digital equity, according to which equitable access is one of the conditions under which significant digital competencies will be formed (Warschauer, 2004; van Dijk, 2020).

It is interesting to note that gender was not a statistically significant moderating variable in the relationship. It implies that once the digital access is institutionalized with the institutional support, gender distribution in techno-literacy outcomes can be significantly decreased. The above observation greatly supports the results of Asad (2025) who estimated that the decisive factor in bridging digital skills gaps among marginalized students is equitable institutional

access. The current research paper adds value to the existing body of knowledge because it shows that the same tendency is also applicable in the context of vocational education, where the applied technological skills are directly related to employability.

**8.4- There are long-step obstacles to Gendered Digital Inequality:** Although the gender differences in quantitative measures were not significant between the genders statistically, qualitative data indicated that there was still contextual and structural hindrances that affected the female learners. These were in the form of fewer opportunities to practice outside the institutions, access to the devices and so out of personal ability and set socio-cultural expectations. Significantly, these limitations were not institutional and were enshrined in the larger social and cultural systems.

This observation mirrored the argument presented by Helsper (2012) where contemporary digital inequalities are manifested more in subtle and indirect ways than in blatant exclusion. In the same breath, as Asad (2025) emphasizes, there are still factors defining digital inequity in Pakistan, notably, financial constraints, inadequate infrastructure, and insufficient awareness. The current paper provides a gender-sensitive contribution to this discussion showing how these latent obstacles have a disproportional impact on the experiences of female learners in the so-called techno-literacy even within the relatively equitable institutional access environments.

**8.5- Policies and Practices:** Taken together, the data support the idea that institutional digital equity programs can be useful in reducing visible gender inequalities in vocational education, especially in regard to the growth of techno-literacy. Nevertheless, socio-economic and cultural realities present the necessity of multi-layered and gender-responsive digital equity interventions. In solving the issue of digital inequality in Sindh like Larkana, efforts to consider infrastructure supply need to cross into areas of providing intervention to enhance

individual possession, community education as well as assistance at family units to help female learners.

Asad and Nazir (2025) recommend that the ideas of improving digital equity must incorporate gender-specific planning, digital awareness initiatives that must be held in communities, and mechanisms of applying targeted financial aid. These are necessary to the transformation of institutional access into sustained personal empowerment, and to the promotion of vocational education having a positive role in inclusive and equitable digital futures in resource constrained environments.

### 9.1- Conclusion

The objective of this study was to analyze gender difference in digital equity and their effects on techno-literacy among vocational students in the city of Larkana in Sindh on a mixed-method approach, based on the digital divide and digital equity theories. On the whole, the results make a sophisticated image.

The descriptive findings indicate the apparent differences in the mean scores based on gender with men learners stating higher levels of digital equity and techno-literacy whereas women learners stated higher levels of barriers to digital access. Such trends concur with the available literature indicating that socio-cultural practices, economic, and institutional constraints remain some of the most common obstacles that female learners in developing economies like in Pakistan face.

It was however, shown that when these differences were subjected to the inferential analysis, they were not found to be statistically significant. The independent samples t-tests did not reveal any significant gender differences in any of the variables of digital equity, techno-literacy, and barriers to digital access. This implies that, in the sampled vocational institutions in Larkana, the male and female learners are subjected to the operation under the typically similar structural conditions of digital access and skill development. An alternative explanation is that recent increases in vocational education and common facilities in institutions

might have minimized blatant differences in the access and minimal techno-literacy rates between genders.

Although there are not statistically significant differences, the moderate mean scores and high variability of the measures of all constructions suggest that, at present, digital equity and techno-literacy cannot be considered optimal, regardless of the sex. The non-normal distribution of the data on items goes another step further to show unequal access to/use of the items by learners. Notably, the marginally increased perception of impediments by the female learners is also in agreement with qualitative inferences and contextual realities indicating that gender-based restraints could be subtle, contingent, and ingrained in the socio-cultural practices and not distinctively created at the aggregate statistical level.

The paper has shown that although the issue of gender imbalance in digital equity and techno-literacy among vocation learners in Larkana is not statistically high, structural and contextual issues remain, especially on young women learners. Digital equity is still a sensitive requirement to reinforcement of techno-literacy and gender still follows the conditioning factor that is predetermined by monetarial, social, cultural, and institutional circumstances. These concerns should be met in order to provide access to inclusive vocational education and prepare an equal workforce.

### 9.2- Recommendations:

The study findings have led to the following recommendations to the policymakers, learning institutions, and stakeholders in development:

i. **Enhance Institutional Digital Infrastructure:** Vocational learning institutions in Larkana ought to continue increasing the access of learners to digital tools, fast internet access, and modern educational software. Collective digital amenities are to be developed with the aim of curbing the tendency of relying on individual gadgets, especially among low-income earning students.

ii. **Specific Support of Female Students:** No significant difference was found but female

learners had comparatively lower barriers. Gender-responsive interventions that women in institutions should be encouraged to take up include increased working hours in laboratories, women-exclusive digital training and learning environments that are safe and supportive toward women in an attempt to enhance their collaboration with technology.

iii. **Embark Techno-Literacy in Vocational Curriculums:** Techno literacy skills must be integrated systematically in all the vocational programs and not as an add-on. Hands on practical digital activity consistent with the demands of the labor market can boost the confidence and employability of the learners.

iv. **Teacher and Trainers Professional Development:** Teachers should be provided with a continuous opportunity to acquire knowledge of digital pedagogy to be able to integrate technology into the educational process effectively. Educator gender-sensitive training can also assist in combating the unconscious biases and assume the inclusive classroom practice.

v. **Interventions at the Policy Level to Advance Digital Equity:** Government and education departments must develop and initiate clear and explicit digital equity policies in vocational education, where gender is prioritized. Internet access subsidies, device provision plans, and public-private relationships may be central in bridging concealed digital divide.

vi. **Address Socio-Cultural Blocks via Community interventions:** Awareness campaigns to parents to curb constraining social norms that will negatively engage female learners to access and utilize digital technologies should be launched on the communities and leaders. The most important aspect of sustainable gender equity is the support at the community level.

Through such suggestions, vocational education in Larkana (and other environments) will leave the minimum effort of nominal access towards the techno-literacy skills and digital equity that gives both male and female students the ability to be empowered socio-economically in the digital era.

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