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Print ISSN: [3006-2497](#) Online ISSN: [3006-2500](#)Platform & Workflow by: [Open Journal Systems](#)<https://doi.org/10.5281/zenodo.22126078>**ICT Online Education and Women Empowerment Breaking Barrier for Girls in Higher Education****Abdul Rehman**

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The present study examines the role of ICT-based online education in increasing female students' empowerment and in overcoming social and economic barriers in educational institutions at the District Bannu Khyber Pakhtunkhwa Pakistan. It consists of two main objectives: understanding the role of ICT-based education in women's academic, psychological, and social empowerment; and examining the role of online education in women's social and economic mobility. A quantitative cross-sectional survey research design was employed, and data were collected from 357 undergraduate women from four girls' degree colleges and one public women's university in District Bannu, Pakistan, through the use of proportionate stratified random sampling. A validated structured questionnaire was used in data collection. The data were analyzed by means of IBM SPSS Statistics, through the use of the multiple linear regression and descriptive statistics. The results indicate that ICT-based online education is a significant predictor of the overall women's empowerment ($\beta = 0.571$, $p < .001$, $R^2 = .326$), with the majority of the gains made in women's empowerment in the areas of academic self-efficacy and intellectual autonomy. Online education has dealt a significant blow to traditional barriers ($\beta = 0.485$, $p < .001$) and economic barriers ($\beta = 0.384$, $p < .001$) by offering women a safe, flexible and culturally acceptable alternative of domestic based learning. Higher education through information communication technologies (ICTs) plays a major role in increasing gender equality and access to education in a rural, conservative area; however, some challenges continue; such as poor Internet, and women sharing one device.

KEYWORDS: *ICT-based online education, female student empowerment, higher education, District Bannu, socio-cultural barriers, gender equality, digital divide*

INTRODUCTION

Higher education spurs socio-economic and intellectual development and promotes gender equity in developing countries.

In Pakistan, Unequal distribution of tertiary education across geographic and gender lines persists. Female students in rural, conservative, and marginalized districts of Pakistan, especially Bannu in Khyber Pakhtunkhwa (KP) province, have several cultural, social, and physical obstructions that adversely affect their education (Rana et al., 2024). Among these, traditional constraints of mobility, care burden, early marriage, and an absence of gender-segregated infrastructure within local educational institutions hampers the enrollment of women into higher education (World Bank, 2023).

Historically, divisions in Pakistan have prompted the use of online education that leverages Information and Communication Technologies (ICTs). Online learning, digital content provision, and virtual classrooms detach the process of instruction from the physical location of the student (Muneer, 2021). For women in Bannu district, Online tools provide them with a safe, flexible, and culturally appropriate means of education. ICT-based education is an important tool for empowering women to undertake degree programs, develop digital skills and thinking skills, and ultimately empower themselves (Shakeel et al., 2026).

Although digital modalities have a lot of promise, integrating digital technologies into rural areas of the Global South has its challenges. The adoption of digital technologies for learning, for example, requires one to cross the digital divide and deal with erratic power supplies, different levels of digital literacy and the patriarchal ownership of technology (Barot, 2020). Therefore, this study aims to determine how ICT in higher education empowers women in Bannu. In doing so, this study will examine the effects of digital technologies and platforms on women's academic autonomy, as well as the role digital technologies play in women's psychological self-efficacy in the context of conservative rural environments.

The complex interfacing of gender, technology, and higher education in Pakistan is defined by a significant divide across different regions. Within the province of Khyber Pakhtunkhwa, the Bannu District reflects Pashtun traditional norms within the context of rarely leaving the house of the husband's family (purdah), and the husband's family maintains the position of honour (Khan et al., 2022). Consequently, the attainment of post-secondary education for women in Bannu has always been below the national averages. Fathers do not send their daughters to universities, even government universities, which are located further away in other cities due to the heightened economic and social costs of travel (Rana et al., 2026).

The explosive growth of new technologies after the pandemic and the wider acceptance of online learning have changed the old patterns of higher education and removed many of the traditional obstacles. Supported by the Higher Education Commission, many institutions of higher education (HEIs) in Pakistan are using automated approaches to teaching and learning through the use of learning management systems. They incorporate online libraries and virtual classrooms to enhance their services and extend their reach (Khan & Aslam, 2021). For young women in Bannu, online platforms based on ICTs provide a discrete, safe, and flexible way to gain a higher education without breaking cultural norms or disappointment to their families. Digital education helps women students get around their isolation,

makes available to them the international resources of education, and allows them to interact (Muneer, 2021).

As far as education is concerned, ICTs have both the potential to empower and the potential to provide barriers. Regarding female students, empowerment is not the same as participation in the classroom. It also includes self-worth, control of their lives through their own decisions, the ability to financially support themselves, and digital literacy (Shakeel et al., 2026). The economic barriers of the situation in Bannu, such as the high price of smart devices and Internet that is not too bad, mean that women cannot access digital education. Furthermore, women are always the inferior choice for the use of the family digital resources (Bibi, 2019).

To appreciate the potential and constraints of ICT-based education in District Bannu, we first need to address the opportunities it creates and the constraints it places on education in District Bannu within the context of its unique socio-cultural environment. While online education enables students to overcome physical boundaries, we still need to conduct myriad studies to determine if digital learning actually advances the goal of females' empowerment or if, in a virtual environment, it simply perpetuates the inequities that exist in the physical world. This study, therefore, aims to make a substantial empirical contribution to the existing body of knowledge to analyze the impact of ICT-based online education on the emancipation of women in the higher education sector of District Bannu.

Objective of the study

1. To examine the role of ICT-based online education in powering female students in higher education institution of district Bannu.
2. To investigate ICT online education helps in breaking socio-cultural and economic barriers to girls' access to higher education.

Research Questions

1. How does ICT-based online education contribute to the academic, psychological, and social empowerment of female students in higher education institutions of District Bannu?
2. In what ways does ICT-based online education assist female students in overcoming traditional socio-cultural and economic barriers to pursuing higher education in District Bannu?

Significance of the Study

This study has strong academic, practical, and social value by producing context-specific empirical knowledge on educational technology, gender studies, and regional development from the perspective of Pakistan and District Bannu, a conservative and backward district. This study also provides context on how and to what extent educational technologies can be employed in highly-conservative and traditional societies. Research findings will allow for the first time policymakers to understand how women in such districts employ ICTs to achieve educational goals and, thus, fulfill the national digital policy and help address the barriers of its implementation.

Pragmatically, the research findings will help university administrators and higher education technology designers and the HEC and the Khyber Pakhtunkhwa Higher Education Department design and implement inclusive digital equity policies. The research findings will help these policy makers understand the specific social and economic problems that constrain women from accessing higher education and devise policies and programs that promote digital equity. The research findings help

universities fulfill their mission to create opportunities to help address the educational divides that constrain women and help promote the economic and social interest of the region.

Delimitation of the Study

- **Geographical Boundary:** This study is strictly delimited to higher education institutions (both public universities and post-graduate female colleges) operating within the geographical boundary of District Bannu, Khyber Pakhtunkhwa.
- **Target Population:** The study exclusively focuses on enrolled female undergraduate students who utilize ICT-based online learning modalities; male students and primary/secondary school levels are excluded.
- **Methodological Scope:** The study focuses primarily on assessing academic, psychological, and social dimensions of empowerment, alongside socio-cultural and economic access barriers, without evaluating formal institutional software codebases or detailed technical network architectures.

Literature Review

The role of Information and Communication Technology (ICT) in higher education has influenced numerous scholars globally, including Pakistan. Use of ICT has disrupted the form of education through Learning Management Systems (LMS), Video Conferencing, Open Education Resources, and other digital tools for collaborating (Khan and Aslam, 2021). In cultures that are conservative and patriarchal, the multiple digital tools have tremendously stimulated social justice and equality of opportunities for women (Shakeel et al., 2026). The literature review synthesizes modern empirical and theoretical studies around the two major objectives of the study.

ICT-Based Online Education and Women Empowerment in Higher Education

Empowerment in higher education incorporates psychological self-efficacy, academic autonomy, social agency, and ability to learn competencies (Muneer, 2021). Women in conservative communities often have gender-equity restrictions affecting their self-expression and engagement in intellectual activities. ICT-based online education has the tendency of providing women an avenue to shore up their social confidence to overcome the classroom gender hierarchy and sometimes, self-thinking anxieties (Barot, 2020). Online education helps women develop an atmosphere for constructive and critical self-expression and provides women the ability to contribute to scholarly research (Shakeel et al., 2026).

ICT platforms not only help students develop academic skills, they facilitate digital literacy, which is important to all employees in today's ever-changing job market. As female students learn to use the digital tools, online communication platforms, and research databases, they begin to see themselves as active, technology users as opposed to passive knowledge receivers (Khan & Aslam, 2021). Rana et al. (2024), in their research, have shown that with the help of digital tools, women in higher education begin thinking of previously unfathomable things, like financial independence and the pursuit of their desired career. For women in Khyber Pakhtunkhwa, where public spaces are still mostly male dominated, virtual learning provides an isolated space for mental engagement and leadership (Khan et al., 2022).

However, it is also agreed that ICT does not automatically bring empowerment. Rather, the quality of digital access and the overall design of digital teaching remain vitally important. If the online spaces designed for teaching are used to deliver traditional didactic (i.e. one-way, passive) lectures without the

use of active or student-centered methods, their positive effect diminishes (Khan & Aslam, 2021). Real empowerment happens when learning opportunities are designed to provide autonomous inquiry and collaborative problem solving and are designed to be continuously evolving (Muneer, 2021). In order to fully understand the extent of empowerment brought upon female students of universities in District Bannu through the use of ICT, it is necessary to evaluate both the psychological self-efficacy developed and the digital skills acquired.

Breaking Socio-Cultural and Economic Barriers Through ICT Online Education

The second major dimension of scholarly inquiry considers how ICT-based online learning works to break deep-seated socio-cultural and economic challenges that impact women's participation in higher education. In rural and culturally conservative areas of Pakistan, such as District Bannu, women's education is negatively affected by the strict control of women's mobility, Pardah, and women's safety during the often-lengthy travel to education campuses (Khan et al., 2022; World Bank, 2023). In many traditional societies, families are forced to stop their daughters' education at the secondary level rather than allow them to attend co-educational colleges or universities that are located in distant towns or cities. By bringing university level education to the homes of learners, online education addresses the spatial and cultural challenges that women in these societies face (Barot, 2020).

Economic issues are also major barriers for women seeking higher education. The financial burden caused by travel to and relevant costs of campus living, food, and study materials, combined with the cost of running houses for parents who have no other male family members to care for them, is especially challenging for lower and middle income families who are forced to prioritize the education of male children (World Bank, 2023). The challenges associated with physically attending a university are significantly reduced by online learning which uses Information and Communication Technologies (ICTs) (Khan & Aslam, 2021). In addition, flexible asynchronous online learning allows women to take care of their homes and other family members while pursuing their university level studies, which is not possible in the traditional campus learning framework (Rana et al., 2024).

There are many benefits of using ICT for online learning in rural KP, but there are challenges. For instance, Barot (2020) has described the case of ladies students in rural KP and how these students have to face the domestic rationing of technology. With rationing of technology, male members of the household maintain and have ownership of the digital devices as well as internet of higher speed. In Bannu and other far-flung areas, the challenge of the online education due to high cost of mobile data and weak broadband connectivity is compounded by the unreliable electricity. Thus, while the ICT based online learning has the potential to help address some of the traditional barriers faced in the sphere of physical and social cultural barriers, there is need to formulate a structured and specific policy aimed at digital poverty eradication and closing the inequity gap for women in higher education.

Methodology

Research Design

This study used a descriptive, cross-sectional survey research design with a quantitative approach. Considering the approach, a cross-sectional survey was appropriate as it captures standardized data from a selected sample of multiple higher education institutions at a given time (Creswell & Creswell, 2018; Saunders et al., 2019). Using this approach, the researcher was able to assess the level of

participants' digital technology acceptance, measure the levels of the constructs of psychological and academic empowerment, and assess the socio-cultural and economic challenges without intervening in the natural setting of the participants (Babbie, 2021).

Population of the Study

The population of this study comprised enrolled female undergraduate (BS 4-year) students across five key public-sector higher education institutions dedicated to female education in District Bannu, Khyber Pakhtunkhwa. The total accessible student population across these five target institutions was $N = 4,700$. The specified target institutions include:

1. Kalam Bibi International Women Institute (KIWI), Bannu(formerly UST Bannu Women Campus)
2. Government Girls Post Graduate College, Mandan Bannu
3. Government Girls Degree College, Township Bannu
4. F.G. Degree College for Women, Bannu Cantt
5. Government Girls Degree College, SurraniBannu

Sample Size and Sampling Technique

To draw a statistically representative sample from the total population of 4,700, the sample size determination table by Krejcie and Morgan (1970) was used, and resulted in a minimum sample size of 357 respondents with a 95% confidence interval and a 5% error bound. Considering potential non-response and uncompleted survey forms, 400 copies of the survey were prepared. Using the method of proportionate stratified random sampling, the participants were selected. The five institutions were considered as different strata, and participants were sampled using the simple random sampling method from student IDs that were randomly generated by a computer, with each female student having an equal chance of being included.

Research Instrument

Data was gathered using a self-administered, structured closed-ended questionnaire developed through an extensive review of validated digital education and empowerment scales (Muneer,2021; Shakeel et al., 2026). The instrument was structured into four distinct sections:

- **Section A:** Demographic characteristics (age, institutional affiliation, academic year, socio-economic background, and internet access).
- **Section B:** Usage patterns and access to ICT tools and Learning Management Systems (LMS).
- **Section C:** Constructs measuring female empowerment across academic, psychological, and social dimensions using a 5-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree.
- **Section D:** Sub-scales measuring socio-cultural barriers (mobility restrictions, *Pardah* observance) and economic barriers (device ownership costs, connection charges).

The questionnaire underwent face and content validity checks by a panel of three senior academic experts in education technology and social sciences. Scale reliability was confirmed via a pilot study with 36 students; Cronbach's alpha coefficients for all primary sub-scales was 0.86 (Hair et al., 2019).

Data Collection Procedure

Formal requests for permissions and ethical approvals were obtained from college principals and university administration prior to undertaking fieldwork. Data collection was conducted over 6 weeks

using the dual mode technique (paper based questionnaires and an online Google Form administered using the class WhatsApp group). Both face to face and online students were included. Informed consent was given to the participants upon which they were provided with a statement detailing the nature, purpose, and voluntary nature of the study, and the assurance of their anonymity and the confidentiality of the data. Out of 400 questionnaires distributed, 357 questionnaires were retrieved (effectiveness rate of 90.5%). Data was analyzed using SPSS (version 28.0). Both descriptive and inferential statistics were used.

Data Analysis and Interpretation

Demographic Profile of Respondent:

Table 1: Demographic Profile of Female Students Respondents (N=357)

Demographic variable	Category	Frequency (f)	Percentage (%)
Age Group	18-20 Years	141	39.5
	21-23 Years	175	49.0
	24 years and above	41	11.5
Total		357	100
Institutional Affiliation	KIWI/ Women Campus Bannu	118	33
	GG Post Graduate College Mandan	97	27.2
	GG Degree College Township	60	16.8
	FG Degree College for Women	47	13.2
	GG Degree College Surrani	35	9.8
	Total	357	100
Level of Study	BS (Undergraduate Years 1-2)	184	51.54
	BS (Undergraduate Years 3-4)	173	48.46
	Total	357	100
Primary Internet Device	Personal Smart Phone	222	62.2
	Shared Family smart Phone	76	21.3
	Laptop/PC	59	16.5
Total		357	100
Primary Internet Connection	Cellular Mobile Data (3G/4G)	265	74
	Home Broad Band/ WiFi	92	26
	Total	357	100

Table 1 illustrates that 49.0% of the female respondents are 21 to 23 years old. The second-most populated group is 18 to 20 years old with 39.5% of the respondents. Only 11.5% of the respondents are 24 years and older. This shows that the participants are young adult undergraduate students in their early to mid-20s. This age group is among the most engaged age groups for social media and internet

use, making their responses highly appropriate for this study. 2. Institutional Affiliation The data shows that the most surveyed group, 33% of the participants, are from KIWI / Women Campus Bannu. The second-most populated group is from GG Post Graduate College Mandan, accounting for 27.2%. GG Degree College has 16.8%, FG Degree College for Women has 13.2%, and the least populated group is from GG Degree College Surrani, accounting for 9.8%. The sample was gathered from 5 women's colleges in the area with KIWI and GG Mandan having the highest number of participants. This shows that there is variety in the background of institutions and that participants represent multiple different colleges. 3. Level of Study Regarding study level, 51.54% of the respondents are in BS Undergraduate Years 1 and 2, 48.46% of the respondents are in BS Undergraduate Years 3 and 4. The sample is distributed almost equally between junior and senior undergraduate students. This provides opportunity for comparison between the early-stage and later-stage University students regarding internet and social media use. 4. Primary Internet Device In terms of primary internet devices used, a large majority of female students, 62.2%, use a Personal Smartphone.

21.3% of the students rely on Shared Family Smartphones and 16.5% rely on Laptop/PC. It shows that smartphones are the main source of the internet among female students and are also the main source of social media. Possessing personal smartphones also makes students more independent. 5. Primary Internet Connection As far as internet connectivity is concerned, 74% respondents rely on Cellular Mobile Data 3G/4G as their primary source of internet and the rest of the 26% rely on Home Broadband/WIFI. The heavy reliance on mobile data shows that most students use the internet on a mobile/portable basis. This shows that the mobile internet infrastructure of Pakistan is becoming more convenient. It also shows that a large amount of students do not rely on home broadband, probably because of availability and cost.

Table 2: Descriptive Statistics for Core Study Constructs (N = 357)

Constructs Scale	No. of Items	Mean (M)	Std. Deviation (SD)	Overall Interpretations
ICT Online Usage	5	3.88	0.64	High Usage
Female Students	12	3.96	0.58	High Empowerment
Empowerment (Overall)				
Academic Empowerment	4	4.12	0.52	High Empowerment
Psychological Empowerment	4	3.98	0.61	High Empowerment
Social Agency and Autonomy	4	3.78	0.69	Moderate High
Socio-cultural Barrier Mitigation	5	4.04	0.62	High Mitigation
Economic Barrier Mitigation	4	3.82	0.71	High Mitigation

The mean for ICT Online Usage is $M = 3.88$, $SD = 0.64$. A mean of 3.88 represents a High level of ICT Online Usage for female students. The low SD of 0.64 shows a high level of consistency. It indicates that

female students use the internet and ICT tools regularly in their daily academic and social activities. Overall, the mean for the Female Students Empowerment construct is $M = 3.96$, $SD = 0.58$. This shows a High level of empowerment. The mean close to 4.0 and SD of 0.58 suggest that the majority of the respondents perceived themselves as empowered through ICT. This suggests that technology has a positive impact on female students.

Academic Empowerment

Academic Empowerment had the highest mean score of $M = 4.12$, $SD = 0.52$ and thus, High Academic Empowerment. Female students strongly agreed that the use of ICT and online tools has improved their academic performance and access to learning and research materials, and enhanced their participation in the learning process. The lowest SD indicates strong agreement among the respondents on this matter.

Empowerment

The mean for Psychological Empowerment is $M = 3.98$, $SD = 0.61$. The results show a High level of Psychological Empowerment. This indicates that the use of ICT Increases self - confidence, self-esteem and offers female students the ability to make decisions for and by themselves. They feel inspired after using online resources.

Social Agency and Autonomy

The combined mean score for Social Agency and Autonomy is $M = 3.78$, $SD = 0.69$. This indicates a High level of Social Agency and Autonomy.

Female respondents acknowledged how ICT helped them have a channel to share their opinions, made connections, and allowed them to make social decisions. However, the mean score was lower compared to academic and psychological aspects, indicating that they may continue to face social constraints.

Socio-cultural Barrier Mitigation - Mean Score = 4.04, $SD = 0.62$

This score indicates High Mitigation of Socio-cultural Barriers. Based on survey samples, ICT was able to break traditional barriers and gender inequities, as well as cultural obstacles in the acquisition of information and access to opportunities. The online environment also provided a safe space for learning and expression for respondents.

Economic Barrier Mitigation - Mean Score = 3.82, $SD = 0.71$

The samples indicated High Economic Barrier Mitigation. Female respondents believed ICT lowered the financial expenses associated with education and the expenses that come with traveling to access opportunities and resources. Online learning, free resources, and digital opportunities made educational services and the development of skills more affordable for female respondents. The slightly higher SD indicates that there is some degree of variation in experiences. From these results, female respondents achieve high ICT usage and experience high levels of empowerment throughout academic, psychological, socio-cultural, and economic dimensions. The greatest levels of empowerment were experienced in the academic dimensions $M=4.12$, while the Socio-cultural Barrier Mitigation dimensions $M=4.04$ empowers female respondents the most. Social Agency and Autonomy $M=3.78$ are in the high range, however, compared to the other dimensions, these dimensions exhibited the least degree of empowerment. The findings show that ICT and online activities have a significant positive impact on the empowerment of female students across multiple dimensions of their life.

Table 3: Multiple Regression Models Predicting Empowerment and Mitigation

Dependent Variable	Unstandardized (B)	Standard Error (SE)	Standardized Beta (β)	t-Value	p	R ²	Adjusted R ²	F
Overall Female Empowerment	0.542	0.041	0.571	13.22	< .001	.326	.324	174.77
Socio-cultural Barrier Mitigation	0.486	0.046	0.485	10.57	< .001	.235	.233	111.72
Economic Barrier Mitigation	0.412	0.052	0.384	7.92	< .001	.147	.145	62.73

Note. Regression predictor: ICT Online Education Usage. $p < .001$.

Table 3 confirms both research objectives. For Objective 1, adoption of ICT Online Education predicted Overall Female Empowerment ($\beta = 0.571$, $t = 13.22$, $p < .001$) with a measured effect on 32.6% of student empowerment ($R^2 = .326$, $F(1, 360) = 174.77$). Thus, in District Bannu, the use and integration of ICT-based learning tools positively impacted the academic, psychological, and social aspects of female students in higher education.

For Objective 2, predictors ICT Online Education were found to significantly impact Socio-Cultural Barrier Mitigation ($\beta = 0.485$, $t = 10.57$, $p < .001$, $R^2 = .235$) and Economic Barrier Mitigation ($\beta = 0.384$, $t = 7.92$, $p < .001$, $R^2 = .147$). Female students were able to use online education to overcome socio-cultural restrictions to mobility and reduce the economic barriers of travel and lodging, thus enlarging their opportunities for education in a conservative society.

Discussion

The empirical findings of this study showcase the impact of ICT-based online education on the empowerment of female students in higher education institutions in District Bannu, Khyber Pakhtunkhwa. The findings show that digital learning tools create empowerment structures for female students and can serve as workarounds for deep-rooted socioeconomic and cultural problems.

The finding that female empowerment is driven by ICT ($\beta = 0.571$, $p < .001$) also supports contemporary international studies that indicate how technology can be a democratic tool to support female empowerment in patriarchal societies (Muneer, 2021; Shakeel et al., 2026). In most conservatively oriented regions like District Bannu, public female university students sometimes face social anxiety and space barriers in co-educational settings. Online learning provides a safe, flexible, and non-confrontational environment that allows female learners to use and develop critical research skills by engaging with online resources and discussion groups, even when they cannot overcome social barriers to learning (Ahmad and Nisar, 2023). The mean score on the Academic Empowerment scale ($M = 4.12$) indicates that using Learning Management Systems (LMS) and digital learning files also help female students gain autonomy and higher self-confidence in academic activities, further supporting the observations of Khan and Aslam (2021) in their studies of the higher education system in Pakistan.

The results for Objective 2 show that ICT-based education lessens barriers relating to socio-cultural ($R^2 = .235$) and economic ($R^2 = .147$) issues. In District Bannu, females used to follow Pardah in the strict sense and Culturally adhere to gender segregation. The movement of females was socially restricted and led to high females dropping out from high education (Khan et al. 2022). With online education, higher education is brought to the domestic area and fits within the cultural norms, and upholds the right to higher education for women. This supports the findings of Rana et al. (2024), stating online education lessens role conflicts among females in the domestic and academic areas in the rural and conservative regions.

On the economic side, the limitations of unstable or slow internet and the purchase of devices create a continuing challenge, but online education reduces the economic costs associated with studying at a university which include daily transportation, food, and accommodation (World Bank 2023). though, the demographic data shows that 21.5% of the participants use shared devices, and 74.0% rely on cellular data. The digital divide remains (Ahmad & Nisar, 2023). While technology provides a solution to the physical barrier, inequities in digital and technological infrastructure must be addressed to provide equal opportunities in education to all females.

Conclusion

This research explored the consequences of ICT-based online education on the empowerment of women students and the removal of barriers in higher education at District Bannu. From an empirical point of view, ICT-based online education enhances females' autonomy, Psychological confidence, and digital competencies. Digital learning platforms help females of Bannu to study at university with the financial constraints, social customs and physical limitations.

The full potential of digital education can only be seized after infrastructure issues like limited access to devices, high and unstable networks and expensive data are resolved. ICT-based online education is an adequate, culturally appropriate approach for improving females' access to higher education and for human capital formation and the promotion of gender equality in remote rural areas of Pakistan.

Recommendations

Practical Recommendations for Policymakers and HEIs

- Through their collaboration, the Higher Education Commission (HEC) and the Provincial Government of Khyber Pakhtunkhwa should develop laptop and tablet distribution programs that are exclusive to females from remote districts of Bannu to counter the issue of device sharing.
- The administrations of universities should collaborate with national telecommunication companies to offer special bundles of low-cost data for use with the institutional LMS and educational portals with zero rated access.
- Educational leaders should develop flexible hybrid curricula that incorporate asynchronous offline learning modules to help females meet domestic obligations and study.
- The local education departments should provide safe, women only, digital resource centers at colleges of Bannu that are equipped with high speed internet and a reliable power supply (solar systems).

Suggestions for Future Researcher

- Researchers should study the employment of the digitally inclined female graduates from University to industry using longitudinal studies.
- Qualitative, in-depth interviews of parents and community elders in Bannu can show how the culture views females who own technology and do online education.
- Empirical research across other districts of Khyber Pakhtunkhwa (for example, Lakki Marwat and Dera Ismail Khan) will provide understanding to the regional differentiations of digital gender equity.

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