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FROM DIGITAL DIVIDE TO DIGITAL BRIDGE: THE ROLE OF ONLINE LEARNING IN RURAL EDUCATION

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ABSTRACT

Focusing on the five key factors of internet connection, device availability, digital literacy, motivation, and the cost of data, the study explores the barriers of the use of online learning platforms. A structured questionnaire was administered to 400 participants, to assess their experiences with online learning. These barriers were quantified in the study using descriptive statistics to assess the extent of the barriers. Respondents identified several challenges, including lack of devices, inadequate internet accessibility, and problems with digital literacy. There are important managerial implications of the findings of this study for platform developers and for educational institutions. Both the use, and the usability, of online learning systems could be profoundly expanded by updates to interfaces, cheaper data plans and better internet infrastructure. Beyond onboarding practices to help engage students, users may also benefit from digital literacy training to close the gaps in user skills. Future studies must investigate the long-term effects of these interventions on learner results and take-up rates, with special consideration for socio demographic factors such as location and income. Comparative studies across countries or regions can also shed light on how infrastructure and cultural differences influence the usage of such platforms. In addition, looking for solutions in modern technology, such as virtual reality or AI, can provide creative solutions to these issues and improve the learning experience.

Keywords: Online learning platforms, barriers to adoption, digital literacy, internet connectivity, educational technology.

1. INTRODUCTION

A rural education in developing countries still faces some challenges, including limited learning materials, low quality education delivery, and limited access to good quality teachers. Recent studies indicate that educational outcomes are often poorer in rural regions compared to urban due to poor quality of teachers, shortage of instructional resources and poorly-maintained tertiary educational facilities (Mishra and Koehler, 2020). Problems such as socioeconomic disparities, long travels from home to schools and the rural-urban educational disparity further deepen the schism of educational experiences (UNESCO, 2021).

To cope with some of these, Online Learning Platforms (OLPs) have emerged. By enabling students to take advantage of high quality content, informed teachers and stimulating learning environments from any geographic location, OLPs present a flexible and scalable alternative to physical classroom teaching (Kearns, 2020). These platforms can also help close the digital divide by offering rural students access to classmates and educational resources through a range of digital technologies (Bates & Sangrà, 2019). There are also promising prospects for the growth of online education given the increasing access to internet connection in rural areas as well as the prevalence of mobile devices (Sarkar et al., 2020).

However, though OLPs have clear potential, there is little evidence about if and how these platforms can effectively raise the level of education among the rural people. Despite the fact that a number of educational researches focus on the advantages of digital learning resources, the information about effectiveness and authentic implementation of OLOP in

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rural is relatively scarce (Basilaia & Kvavadze, 2020). Challenges ranging from OLPs' digital literacy, infrastructure constraints, to socio-cultural limitations remain unaddressed, giving rise to scepticism about the potential challenges and opportunities of integrating OLP into rural education. Therefore, the aim of this study is to investigate how an online learning platform can contribute to bridge the educational gap between rural and urban areas by highlighting the key elements in relation to the effectiveness of online learning platforms in rural areas.

This study seeks to contribute to the emerging dialogue on educational equity and access by examining the benefits and drawbacks of OLPs in rural education. It accomplishes this by "illuminating the potential of digital tools to reinforce and even accelerate the improvement of educational results in disadvantaged societies" (Schleicher, 2018).

2. REVIEW OF LITERATURE AND RESEARCH GAP

Around the world, rural education systems face several challenges including: teacher short-fall, poor infrastructure, limited access to educational materials. It is known for a long time that the largest barrier to quality education outside the metropolitan zones is the shortage of trained teachers (McEwan, 2020). Less resourceful than urban settings, sight locations, and few professional development opportunities results in gaps in the available trained staff (Eppley, 2019). Besides, infrastructure in rural areas is generally poor with unhygienic classroom conditions, outdated instructional materials, and limited access to electricity and internet connectivity for learning (Lyons, 2021). Educational disparities between rural and urban settings are amplified by the fact that few rural kids have the resources they need to learn: access to digital and other resources, access to school books (UNICEF, 2020). In rural regions, this adversity results in lower academic achievement and increased drop-out rates (Barrett et al., 2019).

OLPs (online learning platforms) have emerged as the state-of-the-art tools for bridging the educational divide in rural areas. Students around the world can use world class learning materials from organisations such as Coursera, Khan Academy, and on-line government learning platforms such as India's SWAYAM (Chen et al., 2020), irrespective of location. In the study by Muthuprasad et al. (2021) such platforms offer a wide variety of courses (from primary to tertiary level) and often include interactive elements such as forums, peer-discussions and quizzes to promote student engagement. For example, coursera for more advanced offerings, from international cooperation universities and institutions (Khan Academy provides free video lessons and exercises to help students acquire foundational skills (Jordan, 2021)). SWAYAM is a government-supported program in India which provides free learning courses across numerous domains, including skill-oriented training courses via MOOCs (Pandey, 2020).

A number of studies have investigated the effectiveness of OLPs to enhance education in rural locales. Since OLPs provided access to materials and instruction which were otherwise not available, researchers found that OLPs had the potential to significantly improve educational outcomes in a rural area (Basilaia & Kvavadze, 2020). In a rural Georgia case study, students with no prior exposure to online learning materials excelled in academic achievement and engagement when e-learning was launched in response to the COVID-19 pandemic (Basilaia & Kvavadze, 2020). Offering a wide range of learning resources in local languages, the Diksha platform, part of the government's eLearning strategy in India, has also been associated with improving literacy levels in rural communities (Goyal, 2021). The examples provided in these figures demonstrate that, if properly planned and implemented,

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OLPs have the potential to bridge the achievement divide and offer rural students a better means to enhance their learning (Subedi et al., 2020).

Rural OLPs indicate potential yet several barriers remain for their widespread implementation. A lack of reliable internet access is one of the prominent challenges. Access to the internet is still an issue for many students in our rural areas use of online learning opportunities are still stunted for proper participation -- or lack of -- in the digital age (Mishra, P., & Koehler, M. J., 2020). Digital literacy is also a significant challenge because the teachers and students in rural areas often do not have the necessary skill sets for the efficient use of digital tools (Sarkar et al., 2020). Also, access to OLPs is hindered in these regions by socioeconomic factors, such as the lack of resources to buy electronics, for example, computers and cell phones (Beaunoyer et al., 2020). In addition, rural learners lack experience in self-directed learning environments and, as a result, often face motivational challenges, adversely impacting on their persistence and engagement with online learning (Venkatesh et al., 2020).

Theoretical perspectives that might help explain the acceptance of online learning platforms in rural areas The Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technology Acceptance Model (TAM) are two such theoretical models. Based on Davis's (1989) Technology Acceptance Model (TAM), a person's intention to adopt new technology is largely determined by the expectancy of ease of use and usefulness of the technology. The students' intention to use an online learning platform in the context of rural education would rely on the perceived ease of use, and the perceived usefulness of the online learning platform to their education. Integrating factors such as social influence, facilitating condition (also potentially valuable in the adoption of OLPs in rural locations), Venkatesh et al. (2003), who proposed UTAUT, which extends TAM. These factors are critical for understanding the dynamics of OLP adoption in rural areas where community perceptions and access to resources such as smartphone and internet are often limited (Sarkar et al., 2020).

Yet even as a growing number of studies suggest that online learning platforms (OLPs) could help narrow educational gaps, particularly in rural communities, many questions remain. Previous studies have largely focused on the broader implications of technologyenhanced learning in developed or urban areas with little notice paid to the unique infrastructure and socioeconomic challenges rural communities face (Beaunoyer et al., 2020; Mishra & Koehler, 2020). For example, empirical evidence is sparse on the penetration and use of platforms like SWAYAM and Khan Academy in remote areas with poor digital literacy and internet connectivity, although these platforms have been recognised to improve access to good educational content (Goyal, 2021; Jordan, 2021). Additionally, contextual content and community specific factors influencing the effectiveness of OLPs in rural areas remain sidelined in contemporary literatures (Sarkar et al., 2020). To add to this dearth of knowledge, much is unknown about the uptake behaviors of rural systems toward online learning programs as research utilizing frameworks such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) is often focused on city or higher education surroundings (Venkatesh et al., 2003). Future research on the contextual factors including digital infrastructure, sociocultural influences, and local government efforts that facilitate or hinder the successful application of OLPs in rural schools is needed to bridge this gap.

3. STATEMENT OF PROBLEM AND OBJECTIVES OF THE STUDY

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However, with the resolution of critical challenges such as limited access to qualified teachers, inadequate infrastructure, the unavailability of educational resources, the increasing use of online learning platforms (OLPs) is seen as a major intervention into providing good education for rural school children. However, we know little about the extent to which these platforms are reaching users in rural communities, in which socioeconomic challenges, low digital literacy, and poor internet access often hinder access. The main objectives of this research are: (1) to evaluate how OLPs perform and work to enhance education outcomes and access in rural areas; and (2) to identify the major barriers and factors (like technology issues and motivation challenges) that affect effective implementation of OLPs in the rural areas. The study seeks to understand these aim and offer suggestions to assist educators, policy-makers, and plat form developers in designing digital education systems that are more inclusive and successful for rural communities.

4. RESEARCH METHODOLOGY

In order to assess to what extent OLPs could be used to enhance education for rural opportunities and to identify the major constraints in the adoption of OLPs among students pursuing professional degrees in rural areas of district Ludhiana, the present research adopted the quantitative research approach. The poll was based on a convenience sample of 400 students. These professionals students however, from the various professional degree programs, completed a standardised questionnaire as part of the study. This questionnaire aimed to collect data on their experiences with OLPs, access to technology and challenges faced such as, insufficient digital knowledge, poor network connection and motivation barriers. Data was collected via a five-point Likert scale approach and the questions were prepared based on established undertakings such as the UTAUT and the TAM frameworks. Both descriptive and inferential statistics were used to analyze the results of which to examine the relationship between students' perceived barriers, usage patterns and access to online learning resources. This approach enabled the investigation to generate an understanding of the factors determining the uptake of OLPs in rural areas and make recommendations for improving their effectiveness.

5. RESULTS AND DISCUSSIONS

Since the number is 51.5% of male students (206 students) and 48.5% of female students (194 students), the 400 sample is a fair balance from both sexes in the study. Consistent with an undergraduate population, the majority of respondents (43%) are students in the age group 21-23 followed by 34.3% in the 18-20 age group. Only 15.8% of the sample are 24-26 years old, and 7.0% are older than 26.

Table 1: Demographic Profile of Respondents

Demographic Variables	Categories	Frequency (n)	Percentage (%)
Gender	Male	206	51.5
	Female	194	48.5
Age	18–20	137	34.3
	21–23	172	43.0
	24–26	63	15.8
	Above 26	28	7.0
Educational Qualification	Undergraduate	217	54.3
	Postgraduate	154	38.5
	Diploma/Other	29	7.2
Area of Study	Engineering	114	28.5
	Medicine	86	21.5
	Management	57	14.3
	Law	52	13.0
	Education	46	11.5
Internet Access	Mobile Data	257	64.3
	Broadband	108	27.0

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	No Access	35	8.7
Primary Device Used	Smartphone	275	68.8
	Laptop/Computer	92	23.0
	Tablet	23	5.7
	No Access	10	2.5

The educational distribution of the respondents is as follows: 54.3% are college students, 38.7% are graduate students, and 7.2% are degree/certification-seeking. Engineering is the most popular field of study area with 28.5% of students. There is also a diverse spread of academic interests ranging between 21.5% for medicine, 14.3% marketing, 13% law and 11.5% education. The ability of the respondents to engage with such platforms depends significantly on their access to internet and online learning tools.

Only 27 % of respondents have a broadband connection and 64.3 rely on mobile data to access the internet, which potentially has implications on the speed and reliability of their educational experience. But 8.7% of individuals report that they have no access to the internet, which could create significant barriers to online learning.

The need for learning resources to be optimize for use on mobile may be demonstrated in the 68.8% from smartphones who access the online learning platform. The digital divide in the sample is evidenced by 2.5% of students who claim they do not have a device at their disposal, although a lower amount of students use laptops/PCs (23%) or tablets (5.7%).

Table 2: Frequency Distribution of Online Learning Platform Usage

Question	**Response**	**Frequency (n)**	**Percentage (%)**
Which of the following online learning platforms have you used?	Coursera	103	25.8%
	Khan Academy	86	21.5%
	SWAYAM	57	14.3%
	EdX	34	8.5%
	Others	29	7.3%
	None	91	22.8%
	Total	**400**	**100%**
How frequently do you use online learning platforms?	Daily	69	17.3%
	Weekly	103	25.8%
	Monthly	114	28.5%
	Rarely	57	14.3%
	Never	57	14.3%
	Total	**400**	**100%**
How do you rate your overall experience with online learning platforms?	Very Satisfied	91	22.8%
	Satisfied	148	37.0%
	Neutral	103	25.8%
	Dissatisfied	34	8.5%
	Very Dissatisfied	23	5.8%
	Total	**400**	**100%**
What motivates you to use online learning platforms?	Access to Quality Resources	137	34.3%
	Flexible Learning Schedule	114	28.5%
	Peer Interaction/Community Support	69	17.3%
	Course Certification	57	14.3%
	Other	23	5.8%
	Total	**400**	**100%**
How much time do you spend on	Less than 1 hour	57	14.3%

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online learning platforms per week?	1–3 hours	126	31.5%
	3–5 hours	137	34.3%
	More than 5 hours	80	20.0%
	Total	**400**	**100%**

According to the data in Table 3, Coursera is the top ranked online learning site (25.8%) among the 350 respondents, followed by Khan Academy (21.5%). Just over one-quarter (27.7%) of the students use EdX and SWAYAM and a significant proportion use it for educational purposes (8.5% for EdX; and 14.3% for SWAYAM). However, 22.8% of the students reported that they had never used an online learning platform. This is a significant proportion of the population who are not engaging with online platforms, suggesting potential barriers such as accessibility or motivation.

With respect to frequency, 25.8% of participants use DL platforms weekly, and 28.5% use them monthly. But 14.3% of people infrequently or never use these platforms, which causes deeper concern among educators and lawmakers hoping to encourage consistent use. The majority of learners reported that their general impression of the online learning environments was good and answered that they felt Satisfied (37%) or Very Satisfied (22.8%) with their online learning experience so far. 5.9% were very Dissatisfied, and 8.6% were dissatisfied, which seems to suggest that the accessibility, quality, or delivery from these platforms is sub-optimal. The fact that 25.8% are neutral might be a reaction of indifference based on usefulness of the platform or the relevance of what is being read.

The first reason for the use of learning platform is given to access to quality resources (34.3%) and for the second reason was given to flexible study hour (28.6%). Course certification (14.3%) and peer interaction/community support (17.3%) also conditionally motivate students as well. This is an indicator that quality of content and the content and flexibility of learning are still the main attractions even as credentials and peer networks are of significance.

34.3% of respondents spend three to five hours a week on the sites, while 31.5% spend one to three hours. What's interesting is that 20% of the respondents are on these sites for more than five hours, so some of these users are highly active! Still, there are 14.3% of respondents who spend less than one hour a week on online learning platforms, possibly due to insufficient motivation or lack of time.

Table 3: Effectiveness of Online Learning Platforms

Question	Response	Frequency (n)	Mean	Standard Deviation
Do you believe that online learning platforms have improved your learning experience?	Strongly Agree	114	**3.71**	**1.14**
	Agree	137		
	Neutral	91		
	Disagree	34		
	Strongly Disagree	23		
To what extent do online learning platforms help you gain knowledge compared to traditional classroom learning?	Much Better	103	**3.62**	**1.23**
	Better	126		
	Same	80		
	Worse	57		
	Much Worse	34		

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Online learning platforms have enhanced my understanding of professional degree courses.	Strongly Agree	109	**3.68**	**1.142**
	Agree	132		
	Neutral	80		
	Disagree	46		
	Strongly Disagree	34		
I find the content provided on online learning platforms relevant to my course of study.	Strongly Agree	114	**3.74**	**1.131**
	Agree	137		
	Neutral	91		
	Disagree	34		
	Strongly Disagree	23		
I am able to interact with teachers and peers effectively through online learning platforms.	Strongly Agree	97	**3.59**	**1.23**
	Agree	126		
	Neutral	103		
	Disagree	46		
	Strongly Disagree	28		

As shown in Table 4, there is a general trend for respondents to Agree or Strongly Agree that online learning increases the quality of their education. The mean score of 3.71 and SD of 1.14 illustrate that people have generally positive attitudes toward online learning platforms. The deviation from the mean, which raises the possible variance of the responses, indicates that while many students agree about the benefits of these mediums, a large portion are neither satisfied and/or unsatisfied. Issues such as usability of the platform, the design of the course, or lack of engagement may have an effect in the experiences of students on the other side.

The average score of 3.62 and standard deviation of 1.23 shows a positive perception is thought by respondent to compare to traditional classroom teaching. A significant share of people say that online learning is “Much Better” or “Better” than face to face means of learning. A similar proportion of students, however, continue to rank online learning as "Worse" or "Much Worse," reflecting the perceptions of some that online learning does not compare favourably with classroom learning. The spread of responses implies that for some courses and students the online environment may not provide as many benefits, so pedagogical improvements in interaction and engagement might help to address this.

On the average, the respondents agree that online learning platforms have enhanced their understanding of professional degree course (M = 3.68; SD = 1.14). The level of attitudes of majority on usefulness of online based platforms for professional education is Strongly Agree and Agree. But the emergence of neutral or negative responses suggests that for some students these sites are less valuable in relation to certain professional courses. It appears from the findings of the present work that platforms should offer further specialised learners’ affordances or material in relation to professional-learning needs as well as support for learners that may not be fully engaged with the provided material.

Content offered on online learning platforms is considered to be relevant to the course of study of most students, with a high mean (3.74) and a standard deviation of 1.13. Most responders agree that the content is what they need to learn; this is a good commentary on both the platforms course availability and design. However, there is a proportion that neither

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agrees nor disagrees, which would imply that some of the courses are not particularly well matched to their academic focus or speciality. Platforms might have to offer more specialized courses or tailor the content to better meet the different needs of their students in order to increase satisfaction.

'Many kids report that they have made successful contacts with peers and teachers online — yet a substantial proportion of respondents indicate they are Neither satisfied nor dissatisfied (n=87) or are Dissatisfied (n=28), compared to 223 Strongly Agree or Agree. Mixed opinions on the effectiveness of online interactions are presented in the mean (3.59) and standard deviation (1.23). Online platforms make it easier, but they may no longer be able to entirely supplant what people receive from networking with others in real life. Strengthening peer-to-peer collaboration, expanding interactive tools and upgrading virtual classroom features could all improve the learning process – and alleviate concerns among students who struggle to effectively communicate with others via an online platform.

Descriptive statistics of barricades against the use of online learning platforms for the 400 respondents They reveal many salient points, while the mean scores and standard deviations present greater understanding into them. Insufficient quality of the internet was identified as the strongest barrier (n = 171), with a mean score of 3.81; and SD = 0.97), indicating a high level of agreement by the respondents and low variability in opinion. High costs of data (n = 160) and inability to access devices (n = 137) were also major concerns indicating systemic infrastructure barriers. In so far as high enough digital literacy skills achieve the highest mean of 4.05, SD = 0.88, demonstrating overall confidence, some discrepancy was observed regarding practical platform navigation, with the quote "Struggle with understanding how to navigate online platforms" achieving a lower mean of 3.01 and higher SD = 1.22, indicating diverse experiences.

Table: 5 Descriptives of Barriers to Adoption

Question	Response Option	Frequency (n)	Mean	Standard Deviation
Major barriers to using online learning platforms	Poor Internet Connectivity	171	3.81	0.97
	Lack of Access to Devices	137		
	Low Digital Literacy	114		
	Lack of Motivation	91		
	High Data Costs	160		
Struggle with understanding how to navigate online learning platforms	Strongly Agree	46	3.01	1.22
	Agree	80		
	Neutral	114		
	Disagree	103		
	Strongly Disagree	57		
Internet connectivity is reliable enough	Strongly Agree	69	3.57	1.15
	Agree	126		
	Neutral	91		
	Disagree	80		
	Strongly Disagree	34		
Adequate digital literacy skills	Strongly Agree	137	4.05	0.88
	Agree	149		
	Neutral	57		
	Disagree	46		
	Strongly Disagree	11		
What would encourage you to use online learning	Improved Internet Access	137	4.06	0.92
	Access to Better Devices	91		

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platforms more frequently	More Relevant Content	103		
	Lower Data Costs	46		
	Improved Platform User Experience	23		

Likewise, the reliability of Internet access was rated as moderate with a mean of 3.57 (SD = 1.15), indicating some progress but continued shortcomings. Regarding what might further drive usage, better internet access had the highest level of agreement (mean = 4.06, SD = 0.92) followed by better devices, and more relevant content. These results suggest that even when the digital readiness is on the rise, adequate internet supply that is consistent, affordable, and user-friendly design of the platform are still essential. Policy makers, educational organizations and ed-tech companies need to tackle these challenges with focused interventions, including increasing the availability of broadband, lowering the price of data, providing low-cost devices and creating intuitive learning interfaces with content that's locally relevant, to ensure that digital education is inclusive.

6. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

The study's findings highlight several major barriers to the adoption of online learning platforms, such as poor internet connectivity, lack of access to devices, limited digital literacy, lack of motivation, and the cost of data bundles. The user experience here is highly affected, more so in the regions with less digital infrastructure. The research concludes that while digital learning platforms hold significant promise for increasing education access and flexibility, barriers are currently holding back the resolution. From a management perspective, educational institutions and platform providers should focus on improving internet access reliability, providing affordable or subsidized devices, and implementing digital literacy programs to minimize the barriers users face. Moreover, decreasing access costs or partnering with telecom companies to provide discount rates for educational purposes could potentially reduce the barrier to entry for many students and therefore increase uptake. In addition, institutions could explore custom content and platform enhancements for increased user motivation and experience to incentivize user engagement. Future research should then explore how interventions impact learner outcomes and platform adoption in the long term, and how sociodemographic variables such as geography and income contribute to these barriers. Research examining the utility of emerging technologies such as AI and VR, or comparing learning across different countries or regions, may also offer valuable new insights that can help us to enhance our online learning environments and create more inclusive, effective learning ecosystems.

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