
Implementation Barriers and Affordances of ChatGPT Adoption Among Primary Teachers in Rural Versus Urban Public Government Schools in Pakistan

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Abstract

The mixed-method research was investigating barriers and affordances of implementation of ChatGPT among primary teachers in rural and urban public government schools in Pakistan. Based on the survey responses of 150 primary school educators and semi structured interviews of 20 teachers, having an equal ratio of rural and urban settings, the study pinpointed serious infrastructure, pedagogical, and systemic determinants that affected the integration of ChatGPT. The results showed a significant urban-rural difference in technology access among the teachers, with the rural teachers being severely limited regarding their access to internet connectivity (17% of have access against 78% in urban areas), electricity access, and device access. Nevertheless, the two settings acknowledged the efficiency and content differentiation as well as the engagement of students in the planning of lessons using ChatGPT. Among the barriers were poor technical infrastructure, insufficient formal training, strict curriculum policies, and equity and overdependence of the student concerns. Reduced time of planning, customized content generation, and mixed-ability classroom support were the identified affordances. The paper has arrived at the conclusion that the context-specific infrastructure investment and scaled teacher training models, together with inclusive policies to deal with the digital divide, are needed to implement sustainable integration of ChatGPT in Pakistani state schools. The recommendations are aimed at policymakers, school administrations, and educators to make AI adoption in different resources settings equal.

Keywords: Chatgpt, Artificial Intelligence, Primary Education, Rural-Urban Disparities, Teacher Adoption, Digital Divide, Pakistan

Introduction

Artificial Intelligence technology is quickly transforming the educational systems of all countries across the world, and ChatGPT has become one of the most recent and the most popular applications of AI in education. However, the adoption of AI in primary schools is highly imbalanced, especially in the developing world where the difference in infrastructure is high. Pakistan is a nation with a population of over 230 million people whereby, the number of children enrolled in the primary schools is about 45 million and therefore the quality of education is a critical challenge. Although urban schools in large urban centers such as Karachi, Lahore and Islamabad are starting to consider AI tools in their classroom setting, rural primary schools, which educate about 55 per cent of the school-going age in Pakistan, do not have the basic technological infrastructure. 78% urban schools are connected to computers and the internet while rural school are limited to only 17% which is very low. (Khan, 2024).

Based on this background, to grasp how ChatGPT can be appropriately introduced into primary schools of

the general population one must consider the rural and urban contexts of barriers and opportunities that exist in the context of both the rural and urban population. Primary school is based on principle; students between the age of 5 and 11 years need to be guided, given feedback and be interacted with by human beings. Aspects that ChatGPT cannot substitute, but can potentially complement effectively provided they are introduced in a prudent manner. The research examined the perceptions of teachers, infrastructural limitations, pedagogical affordance, and implementation issues in primary schools in rural and urban Pakistan and offered supporting evidence-based data in policy guidelines on the use of AI fairly.

Literature Review

Global Context: ChatGPT in Primary Education

ChatGPT has shown itself to be useful in educational institutions, making complicated ideas easier to comprehend, creating an age-appropriate answer, and inspiring students to ask questions (Kasneci et al., 2023; Holmes et al., 2019). AI technologies scaffold literacy, numeracy, and investigative learning through differentiated explanations that optimally fit the learning pace of individual learners while using the competency-based education framework. (Sullivan et al., 2023). In developed countries, this research demonstrates that ChatGPT can save teachers 20-40% of preparation time when application is in lesson design, content creation, and development of different practice aids (McKinsey Global Institute, 2023). Also, in working with AI-assisted instruction, students note higher engagement levels, especially when the example provided by AI is put into context and when the teacher is the one who decides on the example (Holmes et al., 2019).

Nonetheless, researchers focus on crucial moral obligations. Little children and children in the primary grades cannot be able to discern between correct information and AI hallucinations or biases that are part of the training data with any degree of reliability (UNESCO, 2023). Children can absorb misinformation without the guidance and verification of the teacher. Moreover, excessive use of AI may lead to the loss of individual thinking, problem-solving capabilities, and face-to-face working skills that are essential in this period of development (Selwyn, 2019). In case of critical evaluation, responsible integration requires teacher gatekeeping, curriculum alignment, data privacy safeguards, and explicit. (UNESCO, 2023; Selwyn, 2019).

The Digital Divide in Pakistan

The education sector of Pakistan is one of the most accurate examples of the acute digital divide of South Asia. The fact that there is a rural-urban school imbalance is not only an issue of magnitude but also an issue of cumulative disparities (Khan, 2024; Criterion Quarterly, 2025). In rural settings, there is poor infrastructure with the rural population being 15% connected to the internet as opposed to the 55% in the urban population (Khan, 2024). This connectivity disparity is directly applied to schools: 17% of rural schools have computers and internet connection compared to 78% of urban ones (Pakistan Today, 2024).

In addition to connectivity, rural schools also experience electricity loss, which is a condition that allows operation of the device (Accountability Lab Pakistan, 2022). A large number of rural facilities cannot supply power dynamically and make technology investments useless (Paradigm Shift Pakistan, 2025). Also, the level of digital literacy in rural teachers is lower significantly, and they have fewer professional training opportunities. Most of the school heads in rural areas have been trained in less than a week in terms of education technology integration (Journal of Public School Teachers, 2024).

Teacher Technology Adoption in Pakistan

There are barriers that have been evident in technology integration in Pakistani schools. The investigation of primary school teachers revealed the major barriers: the lack of power (49% of the teachers mentioned it), the lack of administrative support (48%), the slow internet connection (44%), and the lack of time to train and integrate (Paper Journal, 2020). Moreover, educators also show psychological resistance to technology; not

all of them are ready to use the tools that they cannot touch in their hands or, at least, troubleshoot instantly (EdTech Hub, 2022). It is this seeing is believing attitude that is especially high in under resourced environments where no technical assistance is provided (EdTech Hub, 2022).

Moreover, the Pakistani education system hinders the use of technology because of its organization. Educators are also judged on syllabus coverage speed as opposed to learning outcomes, and uninspired, lecture-intensive, methods against innovative AI-based ones (EdTech Hub, 2022). The role of school leadership is highly significant; the poor school management where headteachers are poorly trained (78% of them have little formal training) leads to non-supporting institutional conditions of pedagogical innovation (Journal of Public School Teachers, 2024).

AI Adoption in Pakistani Schools: Emerging Evidence

Recent survey studies of the adoption of AI among 125 K-12 teachers at Pakistani institutions are a useful source of information (Raza and Farooq, 2025). Although the results cover both state and non-state schools, information on adoption rates is informative. About 30% of the teachers are currently frequently or daily users of AI tools, and 26% are highly familiar with their use in the classroom on a regular basis (Raza and Farooq, 2025). Nevertheless, such aggregate numbers cover important differences: private school teachers are polarized (some use it daily, others do not), whereas public school teachers are concentrated around occasional, exploratory use (Raza & Farooq, 2025).

Notably, 73% of the teachers who were surveyed said they were worried that not all students had equal access to AI devices because there were not enough devices, although only 42% said that all students had equal access (Raza and Farooq, 2025). This equity anxiety is a direct indication of the structural digital divide in Pakistan and a predictor of opposition to the use of AI that can be seen as increasing inequality. Content generation (47% of users) and personalized learning support (56%), however, are most frequently mentioned AI applications, and AI-based grading and tutoring systems are hardly used (13 - 24) (Raza and Farooq, 2025). This trend indicates that teachers consider AI as an additional preparation resource and not the replacement of instructional or assessment roles (Raza and Farooq, 25).

Infrastructure and Affordances for AI in Low-Resource Settings

Nevertheless, recent studies prove that it is possible to integrate AI in resource-limited situations. Mobile devices that are optimized to the low-bandwidth setting for AI interventions are promising (JAAI Network, 2024; Vaidya et al., 2024). Educators that employed smartphone-friendly AI in lesson planning noted that they were saving significant time and administrative load, yet did not have to implement any large device ecosystems (Vaidya et al., 2024). Moreover, in case of the appropriate training, teachers at low-resource government schools were able to implement AI, i.e., to the differentiation-based instruction, and assist both the high-achieving and struggling pupils in the multi-ability classes (Government of Pakistan, 2022). The following examples indicate that context-specific technological and pedagogical solutions can allow the meaningful use of ChatGPT even in the infrastructure-problematic environment.

Research Objectives and Questions

This research proposed to examine the barriers and affordances of implementation of ChatGPT among primary teachers in government schools in rural and urban areas of Pakistan. The research questions were as follows:

1. Determining the barriers to rural and urban primary schools access and use of ChatGPT that are related to infrastructure.
2. Observing pedagogical affordances ChatGPT can provide to primary teaching in a variety of school settings.
3. The readiness and training needs among teachers both in the rural and urban areas.

4. Evaluating systemic and policy-level barriers to equitable adoption of AI in government primary education.
5. The measurement of student impact perceptions and equity concerns that teachers expect to involve the usage of ChatGPT.

The research questions that will guide the study will revolve around:

- Which infrastructure, technological, and systemic obstacles to the adoption of ChatGPT do rural and urban primary government schools in Pakistan have?
- What do primary teachers feel are the instructional affordances of ChatGPT when it comes to lesson planning, content creation, and students?
- What are the perceived barriers and affordances to rural versus urban settings and what are the contextual conditions that explain those differences?
- Which training models and support mechanisms would facilitate sustainable and equal ChatGPT implementation, in both rural and urban primary schools?

Methodology

Research Design

The research design of this study was a mixed methods research design that involved the use of quantitative survey data and qualitative data collected in form of interviews. The descriptive cross sectional design enabled consideration of teacher perceptions, barriers and affordances at one point in time whilst responding to contextual variance between rural and urban environments. Integration of the mixed methods made it possible to triangulate the data: the quantitative survey data gave the breadth and helped to define patterns, and the qualitative interview data gave the depth, nuance, and contextualization.

Participants and Sampling

The research sample was a population of 150 primary school teachers in public government schools in Pakistan, and there was deliberate stratification of the sample in regard to geographic setting. The sample was found in equal measures: 75 rural teachers and 75 urban teachers. Rural respondents were sampled based on schools located in underrepresented regions of Punjab, Sindh, and Khyber Pakhtunkhwa provinces, and sampled based on districts where low internet penetration (less than 20% of households connected) was recorded. In big cities (Karachi, Lahore, Islamabad, Peshawar) where the infrastructure and digital access is more developed and relative to the private facility, urban respondents were sampled in public primary schools. The purposive sampling ensured that representation was made on both schools of different sizes (small schools of less than 100 students, medium schools of 100 to 500 students, large schools of more than 500 students) and spans geographic micro differences between rural and urban classifications. All the respondents were qualified primary school teachers (Grades 1 to 5) with the minimum experience of two years of teaching experience. The inclusion factors included the fact that the participants had to be working in the publicly operated schools of the government, speak either Urdu or English (both official languages of instruction in Pakistani schools) and agree to participate.

Also, there was a qualitative sub-sample of 20 teachers, 10 rural and 10 urban, who underwent semi-structured interviews. The participants of the interview were chosen purposely in order to form a range of ChatGPT exposure: early adopters (self-trained users who had 3 or more months of experience with ChatGPT) moderate users (had no prior exposure but were willing to learn), and non-users (had no experience with ChatGPT). This difference allowed the description of the adoption barriers and facilitators in different levels of readiness in a rich way.

Data Collection Instruments

Survey Questionnaire. A questionnaire of 45 items was created that covered five areas, namely: (a) demographic data (school location, size, teacher experience, gender); (b) school infrastructure (internet access, device access, electricity, technical support); (c) awareness and familiarity with ChatGPT (lesson planning, student engagement, differentiation, workload reduction); (d) perceived barriers to adoption (infrastructure, training, curriculum, equity issues); and (e) perceived affordances and benefits (infrastructure, technical support).

Barrier and affordance variables used 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) depending on the results of the literature review. Open-ended questions were used to request teachers to share what they think is the most significant barrier to adopting AI and how they think the use of ChatGPT could be most beneficial to them. The questionnaire was also conducted as an Urdu and English version so as to be accessible. A pilot test that was conducted on 15 teachers (not part of the final sample) results verified that it was clear, appropriate language, and required a reasonable time to complete (20-25 minutes).

Interview Guide. Semi-structured interviews used an 8-question guide that covered: (a) use of technology in the classroom presently; (b) knowledge of ChatGPT; (c) perceived beneficial outcomes of primary instruction; (d) barriers in infrastructure within the specific school of the participant; (e) training received and missing training; (f) student learning and equity concerns; (g) perceived difference between their school and other geographical schools; and (h) a recommendation to facilitate the implementation of ChatGPT adoption. The interviews were 35-50 minutes long and in Urdu or English depending on the choice of the participant. All the interviews were recorded and transcribed verbatim.

Data Analysis

Quantitative Data

The responses obtained in the survey were inputted into SPSS (version 28) and analyzed through the descriptive statistics (frequencies, percentages, means, standard deviations). Comparative analyses were conducted in which we compared responses of rural and urban teachers in terms of independent samples t-tests of continuous Likert scale measures and chi-square tests of categorical measures (infrastructure availability, prior training, status of adoption). Between-group differences that were regarded as meaningful were computed in terms of effect size (Cohen d). Further, the mean barrier and affordance scores were calculated between rural and urban sub-samples in order to profile the context-specific challenges and opportunities.

Qualitative Data

Thematic analysis was used to analyze interview transcripts in a six-step process: familiarization, through repeated reading, initial coding (open coding), theme identification, through grouping codes into conceptual clusters, theme review, in relation to the entire dataset, theme naming, and writing final report. The analysis was inductive (themes occurred during data analysis but were directed by the research questions). Two independent researchers carried out the coding process in order to achieve reliability; any disagreement was solved by discussing and coming to an agreement. Coding organization and management were done through the NVivo 14 software.

Ethical Considerations

This research was done under a full ethical consent of the institutional research ethics committee. Informed written consent was given by all participants upon having extensive information regarding the purpose of the study, procedures, data manipulation, and their right to pull out. Survey instruments and recordings of the interviews were coded as a means of providing anonymity; no names or identifying information were noted. All the information was kept in secure gadgets with passwords. The report of aggregated results is made in

such a way that no identifiable individual respondents or schools can be singled out. It was assured that teachers would not be forced to participate, and this would not impact their employment or professional status. There were no incentives given to shun coercion.

Results

Participant Characteristics

The sample of the survey (N = 150) was broken down into 82 rural teachers (54.7%), and 68 urban teachers (45.3%). This minimal over-representation of the rural respondents was as a result of the survey completion being low in urban localities with the teachers having more competing demands. Gender distribution in the integrated sample was 58 male (n=87) and 42 female (n=63), which is the composition of the teacher workforce in Pakistan. Teaching experience was between 2 and 28 years (Mean experience = 11.3, SD =8.4). The distribution of school sizes varied between school setups: the rural schools had an average of 187 students (SD = 119) and the urban schools had an average of 456 students (SD = 214) due to the differences in infrastructure capacity. All of the sampled schools were public schools, run by the government, with no computer labs or formal technology program, but a few urban schools had some desktop computers that were used administratively.

The participants of the interview (20) were also evenly divided (10 rural, 10 urban) and also diverse in terms of ChatGPT exposure: 7 users (3 rural, 4 urban) were early adopters who initiated using ChatGPT on personal devices to plan lessons; 8 (5 rural, 3 urban) were moderate users who had the limited and, nevertheless, genuine interest; 5 (2 rural, 3 urban) had no experience with ChatGPT. The experience of the interview participants was between 3 and 25 years (M = 14.1 years) with 65% (n = 13) having some type of technology training in their career although most of it was the scanty type (average 1-2 days).

Infrastructure Barriers: Rural-Urban Comparison

Internet Connectivity and Availability of Devices. The rural and urban schools had significant infrastructure disparities which were statistically significant. On internet availability at school, 72% of the teachers in urban schools (n = 49) indicated that their school was connected to the internet, whereas only 18% of teachers in rural schools (n = 15) indicated this. $\chi^2 (1, N = 150) = 56.4, p <.001$. Nevertheless, the qualitative interviews showed that internet connectivity was not the same as trustworthy access. The urban teachers reported that, though there is internet, bandwidth is mostly not enough to support more than one or two users at the same time and access is mostly limited to the administrative personnel. One city principal said, "We do have internet in the office; however, it would crash should 30 children attempt to use ChatGPT at the same time.

In terms of owning a personal device, urban teachers (n = 44) were more likely to possess a smartphone that can access ChatGPT (65 %) compared to rural ones (38 %) , $\chi^2 (1, N = 150) = 13.8, p <.001$. The ownership of computers was more unequal also: 42 % of urban teachers (n = 28) had personal computers, and 8 % of rural teachers (n = 6) had them. Such forms of ownership imposed by the combined disparities in incomes of rural and urban teachers (who were frequently given disparate scales of payments) and the accessibility of affordable gadgets in city markets.

Electricity Supply and Technical Support.

The issue of electricity reliability was a serious but frequently ignored problem especially in rural settings. 22% of rural teachers (n = 18) said that they had reliable electricity supply during the school day, and 89% of urban teachers (n = 61) said they had adequate supply, $\chi^2 (1, N = 150) = 76.8, p <.001$. The conducted interviews in the rural areas showed that it was not possible to charge or use the devices due to scheduled power cut (between 4-8 hours a day in certain areas). A Sindhi rural teacher said, that they are only supplied with electricity between 5 AM and 9 PM. How will I make use of ChatGPT in school?

The availability of technical support was literally nonexistent in the rural environment: just 5% of rural schools

(n = 4) indicated that they had any kind of IT support, whereas 31% of urban schools (n = 21) had some form of technical support at least a few times, either provided by the local education department or brought in under contract. In the case of malfunction of devices in the rural schools, it had to be repaired by traveling to the district towns, which was a cost and time constraint to solve that problem.

Internet Price and Data Accessibility.

Internet access cost is not the most significant constraint but worsened the infrastructure problems. Rural educators claimed that to have reliable connection mobile data plans took up 15-20% of monthly salary, compared to urban educators that reported the same plans as cheaper in comparison to income. One of the rural teachers had remarked that a monthly internet package is 3,000 rupees. That's 10% of my salary. I cannot defend my data to experiment with Chatbots on work-related tasks when I have my family to feed.

Pedagogical Affordances: Perceived Benefits and Opportunities

Even with the infrastructure limitation, rural and urban instructors were aware of the considerable pedagogical opportunities of ChatGPT. The means of affordance ratings were obtained using items related to five benefit aspects of lesson planning efficiency, content differentiation, student engagement, less teacher workload, and classroom management support.

Lesson Design and Content Creation.

The best-known affordance of ChatGPT was the lesson planning support. Urban teachers had a 4.2/5.0 (SD = 0.8) mean agreement that ChatGPT could speed up the task of lesson preparation, whereas rural teachers did so, although with a smaller difference, 3.8/5.0 (SD = 1.0), $t(148) = 2.9$, $p = .004$. Educators liked that ChatGPT could provide multiple explanations of the same concept, which they could use to align the content with the level of student comprehension. According to a country teacher, ChatGPT provided me with five explanations regarding fractions. These I never had time to make out on my own. Even the weak students have a clue now. Generating of content was not limited to single lesson notes: teachers employed ChatGPT to generate practice problems, create story prompts to learn language, or create discussion prompts. The same application was rated equally by urban teachers (M = 4.1/5.0, SD = 0.9) and rural teachers (M = 3.6/5.0, SD = 1.1), but with a slight difference in the level of confidence of urban teachers.

Mixed-Ability Support and Differentiated Instruction.

Both settings showed the potential of ChatGPT to work with mixed-ability classes, a long-time issue in Pakistan where the classes are 40-60 students with vastly differing amounts of prerequisite knowledge. Urban and rural teachers agreed that ChatGPT could be of use in the differentiation process by averaging 4.0/5.0 (SD = 0.9) and 3.5/5.0 (SD = 1.2) respectively, $t(148) = 3.2$, $p = .002$. Educators explained how they would come up with simplified descriptions of learners with problems, and enrichment work of higher-achieving students-functions that are not usually emphasized in resource-intensive environments because of time-constrained situations.

One teacher in a city school taught: In my classroom, there are those children who can read fluently and those children who can hardly make out letters. ChatGPT can assist me in making contents to both of them without having to work until 11 PM.

Learner Involvement and Amotivation.

An average of 68% of the urban teachers (n=46) and 55% of the rural teachers (n=45) expressed that ChatGPT could help to boost student engagement. The increased confidence of urban teachers was probably an indication of exposure to more classroom technologies. Nonetheless, in the case of rural teachers who had tried ChatGPT-generated interactive content (such as chatbot-style quiz games that teachers could then tweak

into a classroom-friendly format), they noted that students could be seen to be enthusiastic. One country-teacher explained that when they demonstrated children how ChatGPT could answer the questions, they were surprised. They were unusually numerous in their inquiries.

Workload Reduction.

It had a large perceived affordance of reduction in administrator and planning burden by the teacher. The mean of agreed with ChatGPT in terms of their workload was 4.3/5.0 (SD = 0.7) in urban teachers and 3.9/5.0 (SD = 0.9) in rural teachers, $t(148) = 3.1, p = .002$. Reducing the workload is practically important in the environment of Pakistan, where classes are large (average of 50 or more students), and the support staff is limited. Educators observed that designing different content to support 50 students will not be sustainable without the help of AI, but will be possible when ChatGPT can come up with early versions that can be revised by the teacher.

Systemic and Pedagogical Barriers.

Outside of the infrastructure, pedagogical and systemic barriers to integrating ChatGPT were also identified by teachers, but they were more pronounced in rural settings than in urban settings.

Rigidity of Curriculum and Pressure to be accountable. One of the strongest obstacles proved to be the structure of the curriculum in Pakistan: teachers are rated almost solely by the speed at which they cover syllabuses, instead of their learning outcomes (EdTech Hub, 2022). In response to open-ended items on barriers (open-ended item) 71% of rural teachers ($n = 58$) and 64% of urban teachers ($n = 43$) responded that they were pressured to cover the textbook in the given time restrictions. This has the effect of disincentivizing innovative, student-paced solutions ChatGPT could make possible.

One of the rural headteachers described it as follows: The provincial education department comes once a year to ensure that we have covered the curriculum. Otherwise, it is a bad portrayal of the school. ChatGPT will also tend to make students learn more effectively and, unfortunately, more slowly; we simply do not have time to do so.

This is increased rigidity through the annual examination system. Although pedagogical rhetoric is about comprehension, there are factual tests, which are annual exams. The rationality of teachers is to achieve good results on exams, rather than deep learning or ChatGPT-powered exploration (EdTech Hub, 2022). In urban teachers this was just as much but with a little more leeway as school autonomy; provincial control over rural government schools is more-strict.

Fears of Over Reliance and Cheating Among Students. Issues related to the implementation of ChatGPT were common regarding students bypassing learning or committing academic dishonesty. An average of 72% of rural educators ($n = 59$) and 68% of urban educators ($n = 46$) said they were concerned that students would grow too reliant on ChatGPT to find the answers instead of being able to solve their own problems. Further, 81% of rural teachers ($n = 66$) and 79% urban teachers ($n = 54$) were concerned that learners would use ChatGPT to plagiarize homework.

These were concerns of true pedagogic view: teachers realized that autonomous struggle is developmental. Nevertheless, according to the interviews, teachers did not have a clear set of guidelines on how to differentiate between fair use of ChatGPT (such as generating ideas) and bad use of ChatGPT (such as answering an entire homework). There were no policies of the school that increased the uncertainty.

Teacher Preparation and Technical Preparedness.

The proportion of rural teachers ($n = 18$) who had any previous training about AI or chatbot $\chi^2(1, N = 150) = 2.1, p = .146$, not statistically significant, probably because of the lack of training in both directions) is only 22% and 31% of the urban ones ($n = 21$). Nevertheless, as interview data showed, there is significant nuance to that: the rural teachers who were trained received much shorter, one-time workshops with little or no follow-

up, whereas urban teachers had a higher probability of being involved in informal learning through online self-study or collaboration with peers.

Urban teachers were found to have 3.4/5.0 (SD = 1.2), whereas rural teachers were found to have 2.8/5.0 (SD = 1.3), $t(148) = 2.9$, $p = .004$ when asked about confidence in using ChatGPT with students. This small gap of confidence, combined with barriers of infrastructure, formed dual reluctance in the rural areas: I am not certain that I could do that in case I would want to.

Equity Concerns and the Digital Divide Within Schools

An important result was the issue of equity: even within schools the differences in access were acute. Educators were concerned that the use of ChatGPT would benefit those students who have home access to devices and the internet. Mean percent expressed that introducing ChatGPT-supported lessons would disadvantage students who do not have access to home expressed concern, $\chi^2(1, N = 150) = 0.9$, $p = .34$ (not statistically significant).

This worry was increased by rural teachers: "In my classroom, it might be 5 children with smartphones. What about the other 45? By designing lessons based on ChatGPT, I am giving up on most of them. This intra-school digital divide is a manifestation of within-class socioeconomic disparities: even in the countryside, certain families have access to devices and others are unable to purchase them.

Qualitative Insights: Circumstantial Domains of Barriers and Affordances.

Analysis of the interviews brought out contextual aspects in which a quantitative data was not able to capture. Rural situation: Technology as Desire. The sentiments of the rural teachers were the enthusiasm with caution. Technology: such as ChatGPT was an expression of idealism of modern pedagogy, but infrastructure dictated compromise at all times. A teacher in the country simplified this tension: "I understand that ChatGPT is excellent. I read it online on Sundays through mobile data. However, Monday morning, I am back to my teaching 55 children with four pencils to be shared among them and no internet.

Rural affordances were commonly low-tech adoptions. Some primary school educators reported that they used ChatGPT responses (accessed on personal phones using mobile data) and transcribed them (manually) to print out and handout to students. Although this method is labor-intensive, rural students were given the opportunity to be exposed to some ChatGPT-generated content. A creative teacher in the rural area made a printed weekly ChatGPT quiz by using the answers that she generated at home, and by sharing them with learners that did not have access to a device. She said, and it is not what ChatGPT was supposed to do, but it makes my students think harder and that is important.

The emotional barriers were also pointed out by rural teachers: most of them believed that they were left alone by the change in technology. Older teachers (mean age 48 in rural sample) were anxious about learning new technologies, saying they are too old to learn about computers. This feeling was not as strong in the urban settings where the teachers were younger (average age 41) and there was more peer support of technology.

Urban Situation: Creative constrained innovation. Urban teachers reported greater experimentation but in frustrated circumstances. The use of ChatGPT became a preparation tool because of the internet overload in most cases, and the classroom was not used by the teachers in the city. An urban teacher described it as follows, I do everything with ChatGPT at home and carry printed material to class. The only method of guaranteeing quality is that way. This strategy involved individual internet spending and access to the workspace privileges not available to every teacher.

Peer support networks were considered urban affordances. Multiple schools in urban areas said that they used informal teacher WhatsApp groups in which they discussed ChatGPT prompts and materials generated. Although such networks were not institutionalized training, horizontal learning was facilitated by these networks. Urban teachers also spoke of using ChatGPT as a tool of student-focused learning by assigning lessons as homework: I will give students a homework to read on a topic using ChatGPT and in the classroom

we will discuss the results. The tool is not in their classroom yet it is a part of their learning process. Common Ground: Leadership Void and a Policy Vacuum. Rural and urban teachers appeared to unanimously agree on the lack of school and provincial policies that regulate the use of ChatGPT. This was the reply of an urban headteacher, who wrote, the government has not informed us on whether to use ChatGPT, how to use it, and whether it is permissible. So we stay quiet." Conservative default arose due to this policy vacuum: without explicit authorization, teachers did not use ChatGPT even when they realized that it was advantageous.

There was unstable leadership in schools. Other headteachers (more typical in urban institutions) pushed their staff to look into AI; others expressly deterred it, as they perceived they would end up losing control or commissioning academic integrity violations. The openness of leadership was not intrinsically associated with the school size, as well as the location; instead, it was an indication of personal attitude and vision of the headteacher. Rural headteachers who had adopted the innovations helped teachers in the experiment with ChatGPT, whereas urban headteachers who were conservative did not, even though they had better infrastructure.

Recommended Support Mechanisms and Sustainable Integration Pathways

When teachers were questioned on what would enable them to embrace ChatGPT, they gave responses that were context-specific.

Some of the priorities of rural teachers were: (a) government-subsidized mobile data plans specifically intended to support education; (b) offline or low-bandwidth ChatGPT alternatives; (c) train the teacher models where district education officers train all rural teachers individually by topic and grade level through regular monthly digital or phone calls; (d) printed resource guides with pre-generated ChatGPT material by subject and grade level so that the rural teacher will not necessarily have to generate content online.

It was the priority of urban educators: (a) to invest in school-level bandwidth that could accommodate the use of the internet in the classroom; (b) formal and ongoing professional development, which would now become a part of the school routine; (c) changes to the curriculum that would ensure flexibility in pacing; (d) explicitly stated institutional policy and ethics; (e) teacher communication and resource-sharing platforms (such as centralized archives of approved ChatGPT prompts and lesson plans).

The two settings need: (a) student digital literacy and responsible use of AI teaching; (b) provincial education department policy frameworks that explain how AI can be utilized; (c) non-equity protection by policies that fairly access content assisted by chatbots (non-users are not disadvantaged); (d) protection against inequity by policies that fairly access content aided by chatbots (setting up policies that equitably access content as part of teacher assessment).

Discussion

Understanding the Rural-Urban Divide in ChatGPT Adoption

The key idea of this study is that both rural and urban primary teachers see the pedagogical potential of ChatGPT in equal measure, but have radically different implementation realities. Although urban teachers claimed much greater access to infrastructure, neither of them had institutional preparedness to enable meaningful integration of ChatGPT. The difference in the infrastructure (18% vs. 72% school internet access; 22% vs. 89% reliable electricity) is consistent with the established digital divide in Pakistan but seemed less decisive than systemic and pedagogical aspects (Khan, 2024; Pakistan Today, 2024).

The presence of ChatGPT affordances to rural teachers even with limited access to it indicates that perceived utility is not partially a matter of hardware. Educators imagined the low-tech solutions (printing ChatGPT texts, transcribing answers, making peer learning work around AI-generated texts). This strength goes against the accounts of a lazy, uninspired rural teacher who is not interested in innovation. Instead, rural teachers were viewed as creative in problem solving under restrictions, which can be an important contribution to

policy.

Nevertheless, it is not fair to maintain such adoptions. Educational leaders would not want the teachers to use their own efforts and money to fill infrastructure gaps. The reality that teachers in rural areas spend 15-20% of their salary to be able to access ChatGPT is an important instance of equity violation: people with lower income need not spend money to use AI.

Barriers to Systems as the Main Obscurities.

Another unexpected discovery was that infrastructural, especially curricular and accountability structures, rather than infrastructure per se, were major obstacles to adoption in even urban locations with sufficient technology. The completion of the syllabus evaluation model is in direct contradiction with the pedagogical processes facilitated by ChatGPT (student-directed, explorative, and differentiated learning). This is a policy issue, rather than a technology issue.

The Pakistani curriculum and examination system was made in traditional and teacher-focused teaching. The affordances of ChatGPT, specifically differentiation and personalization, are also harmed as the incentive of teachers being urged to keep the pace the same (EdTech Hub, 2022). Significant integration thus involves more than the provision of technology in the curriculum.

The implications of this finding are immense: the absence of accountability systems in offering hardware creates the illusion of progress and leaves major hurdles in their place. Technology efforts in other developing countries have a high failure rate since they tend to believe that infrastructure is the major limit and disregard institutional barriers that cannot be solved with technology only (EdTech Hub, 2022).

The equity is of concern as a limitation to adoption, rather than a detail of implementation.

It is worth highlighting the fact that, according to the research, 77 percent of teachers in rural and 73 percent of urban school districts were interested in the within-classroom digital divide. Teachers have every reason to be concerned with the aggravation of inequality. When 38 percent of teachers in the rural setting and 65 percent in urban areas have access to a smartphone, the use of ChatGPT in the teaching field results in inequality between students with access to devices and those without access to a device.

Significantly, these issues are not motivated by the opposition to innovation but by the justifiable pedagogical ethics. Educators know that it is impolite to present AI-related materials without making sure that every learner will be able to use it in order to practice inclusivity. This understanding should be reflected in policy: The policy regarding the adoption of ChatGPT needs to be active in terms of access equity; either by distributing the devices universally, providing offline options, or being explicit that the use of ChatGPT will never be a condition of learning the major content in the course.

Credential Problems What Teachers Need.

The percentage of teachers who had undergone training about AI was only 22-31% and the interview information showed that the training was usually shallow. However, when provided with reflective time, teachers were found to have a high conceptual knowledge of the potential of ChatGPT. This implies that teacher capacity is not the barrier, but unstructured, context inappropriate training and institutionalized support.

An efficient teacher training must be: (a) context-sensitive (knowledge of the rural-urban difference in infrastructure and capacity); (b) not a single workshop; (c) not focused on tools, but pedagogy; (d) tied to curriculum and system of accountability. Models of train-the-trainer that used the district education officers were found to have potential in rural settings where accessibility is constrained by geographic dispersion of external facilitators.

The Policy-Practice Gap

Perhaps the most compelling conclusion was no school/provincial policy on the use of ChatGPT. This vacuum

produced conservative default: without clear guidance, school leaders and teachers were reluctant to use ChatGPT, despite their awareness of such benefits, and a majority of rural and 85% of urban teachers stated they wanted school policies about AI use, which suggests their own institution requires clarification.

Policy should clarify: (a) how ChatGPT should and should not be used in elementary school; (b) data privacy on sharing the information with AI; (c) academic integrity (what is good and what is bad); (d) the issue of infrastructure investments; (e) the issue of teacher training; (f) the issue of equity. The lack of a policy cannot be viewed as an authorization; it is a sign of the policy lag in the ever-changing technological environment.

Consequences to Developing Country Contexts.

The findings of this study are applicable to other developing countries that share same infrastructure and institution attributes as the one in Pakistan. Its twofold conclusion that both infrastructure and systemic barriers limit adoption (systemic barriers are main in certain aspects) implies that the global AI-in-education effort should go beyond the digital-access paradigm and cover curriculum, accountability, teacher training, and institutional preparedness. Institutions that transfer technology without adapting the transfer of technology experience low adoption and little effects (EdTech Hub, 2022).

Limitations

Although this work has a rich contextual background, it has a number of limitations.

Sample Representativeness. The sample (N = 150) which is the survey sample was purposely stratified geographically and also is a small proportion of the estimated population of 350,000 plus primary school teachers in Pakistan. Although attempts have been undertaken to capture schools of different sizes and districts, the sample might be less representative of extremely rural settings (e.g. mountainous regions with low infrastructure density) and all variations in provinces. Also, the sample of volunteer survey respondents might be technologically primed than typical, which creates participation bias.

Self-Report Data. The research was completely based on the perceptions of teachers and their self-reported practices. To confirm statements about the use of ChatGPT or student engagement, no classroom observation was performed. Teacher reports can be aspirational not behavioral or there can be social desirability biasness of positive comments on innovation. Also, interpretation of the Likert scale items can be different in the respondents; what a certain teacher considers as often other can consider as sometimes.

Cross-Sectional Design. The data were obtained at one of the points of time (January 2026) and not on a course. There is a fast-changing state of ChatGPT and the attitude of teachers; the results might not be relevant in six months. It would improve the data to be collected longitudinally in order to observe how the patterns of adoption evolve as the infrastructure evolves, training is introduced and new policies are being established.

Student Data Absent. Although this research involved perception of teacher on student influence (engagement, learning outcomes), no direct evidence of student outcome were involved. There were no pre-post achievement tests, learning gain tests and independent student surveys. Thus, in question are the actual effects of ChatGPT on student learning based on their perceptions by teachers.

Limited Qualitative Depth. Although interviews were helpful in terms of context, the sub-sample was only 20 people, and the duration of the interview was 35-50 minutes, which should have been even shorter to allow an in-depth approach. Greater effort in ethnography of classrooms trying integration with ChatGPT would be able to produce more insights into the real-life situations involving teachers and students interacting with these tools.

Rural-Urban Classification.

The rural-urban dichotomy, however pragmatically convenient, hides the variation within the rural and within the urban. In the proximal urban sites, there are rural schools that are more well-infrastructure compared to their remote urban schools. Overall, more granular geographic categorization (such as peri-urban, remote

rural) would show potentially different trends.

Limitations of the infrastructure data. The information on infrastructure evaluation was based on teachers report (Does your school have internet?) without objective confirmation. Systematic measurements of reliability, bandwidth and accessibility of reported infrastructure were not done. Real internet connectivity could be worse or worse than teachers think.

Implications for Policy and Practice

For Government and Policymakers

1. **Develop extensive AI-in-Education Policy:** The federal and provincial education departments in Pakistan need to develop a coherent and evidence-based policy on the use of AI tools in schools. The policies have to specify: the correct applications (including lesson planning, generation of content, student-oriented research) and the incorrect ones (including, but not limited to, substituting teacher assessment, using student data without authorization); the privacy of data; equity (so that no student is disadvantaged due to the use of AI); teacher training and support.
2. **Uncouple Assessment with Meeting Syllabus:** The current accountability practices are a direct impediment to pedagogical change like the use of AI. Curricula departments will need to transform the assessment model to the competency-based model since the pace assessment will compel teachers to be more flexible with the differentiated model (with AI assistance) that will be implemented on the students with particular needs. Another precondition to the meaningful adoption of ChatGPT is a systemic change.
3. **Invest in Infrastructure Strategy:** The infrastructure investment is necessary but it should be undertaken strategically keeping in mind actual impediments. The schools in the rural areas must have electricities and internet access; this cannot be an optional gimmick such as buildings and furniture. Inefficiently on the other hand, it is not possible to provide technology without curriculum flexibility and training. A package investment should be made infrastructure and training and policy support.
4. **Provincial Education Department Standards and Pathways of Set Teacher Training:** The provincial education departments will be to insist on the constant professional growth related to digital tools and AI, and the minimum (as an example, 10 days a year) standards (in-service training). Training has to become a school routine, and not an alternative at a post-school seminar. They should install train-the-trainer models in the rural areas that would use the district education officers.
5. **Assure Equity Assurances:** It should be stated in the policies that inequities within the classroom should be ensured. The availability of devices and home internet should not be a condition to ensure that a student can complete lessons enhanced by ChatGPT to the full to the end. Schools and colleges using ChatGPT must provide alternative access in order to have all students at the same level of access to core material.

For School Leaders and Administrators

1. **Create Positive Institutional Culture:** Headteachers are advised to explicitly sanction responsible exploration of Chatbots, communicate the same to their colleagues, and protect against the adverse eventuality in the event of considered effort of using Chatbots. Without leadership, the teachers go back to non-experimental conservative practices.
2. **Investigating and collaborating with Teachers:** Have regular (say, monthly) staff meetings, where ChatGPT and the digital tools are the focus. Encourage mutual learning, resources sharing and problem-solving. The horizontal learning networks are more sustainable than the top-down training.

3. **Develop School-level AI-Use Policies:** Before governmental policy considers this issue, school administrations should develop interim policies about AI-use in their schools by expressing policies about how AI can be utilised, academic integrity principles, and data security, and student access. The teachers, headteachers and parents should be involved in the development of such guidelines, and this makes stakeholders buy in.
4. **Support Curriculum Flexibility:** Leaders in schools must negotiate with provincial education departments the need to have flexibility in the curriculum and revised accountability. Schools on their own cannot change the process of evaluation but the collective action by the school leaders can lead to a change in the policy.

For Teachers

1. **Engage in Peer Learning:** Teachers do not need to wait until they receive formal training to begin to learn ChatGPT. The teachers who are somewhat familiar have to share learning with others. WhatsApp groups, unofficial meetings and demonstration lessons are the good peer learning processes. The integration of geographically separated, rural teachers can be done through digital channels.
2. **Design Fair Lessons:** Design equitable lessons, that is, when creating lessons that are reliant on the ChatGPT or content generation, make the lesson such that students do not need to go to ChatGPT on their own. ChatGPT cannot be applied as a student facing tool, and this needs to have access to a device, unless devices are also availed to students.
3. **Dwelling More on the Pedagogy and not the Tool:** ChatGPT is not a destination. The question that the teachers ought to pose is, Does ChatGPT make my students learn this concept better? If the answer is no, don't use it. When yes, it is required as a supplement instead of direct teaching, feedback and human interaction that students are required to have in primary grades.
4. **Document and Share Learning:** The users of ChatGPT innovation require the capability to compose about their experiences, issues, and accomplishments. Blogs, WhatsApp groups or district professional learning networks can assist individuals who have already managed to face such difficulties.

For Researchers and Academia

1. **Longitudinal and Observational Studies:** Future researches should be conducted using longitudinal designs that compare adoption of practices by teachers over a period of time, classroom observation to ascertain practice adoption, and direct student outcomes. This study will establish the no point perceptions; this will have to be confirmed by behavioral and achievement statistics.
2. **Comparative Implementation Studies:** A study should be carried out on the difference in the levels of adoption of the ChatGPT based on the curriculum models, accountability systems, and background of teacher preparation. Does Flexibility in Curriculum Support AI integration? Do teachers with different training have any differences in the usage of AI?
3. **Equity-Based Assessment:** As the use of ChatGPT increases, research needs to be conducted rigidly on whether it is closing or shrinking achievement gaps. Deaggregate student outcome statistics according to their use of device, home internet, and socioeconomic status.
4. **Low Resource Technology Innovation:** Develop and test AI systems in actual learning scenarios with low-bandwidth, offline, and low-cost. Somehow, Generic ChatGPT might not be the most suitable in the classroom of developing countries; perhaps a place-based tool would work better and be more effective.

Conclusion

This was a mixed-method research study, which focused on investigation of the barriers to implementation and affordances of the application of ChatGPT by primary teachers in rural versus urban, Pakistani public

government schools. The study disclosed a more subtle image: both rural and urban educators were aware of the significant pedagogical importance of ChatGPT in planning the lesson, differentiating the content, and engaging students on the same scale. However, they experienced strikingly different infrastructure access, and the rural educators did not have dependable internet (18% vs. 72% school access), electricity (22% vs. 89% dependable supply), and personal devices (38% vs. 65% smartphone ownership).

Nonetheless, infrastructure obstacles were not quite absolute determinants of adoption. More fundamental barriers were found: the curriculum cultures that discourage innovation by evaluating syllabus completion; no institutional policies to guide them; ineffective teacher preparation; and valid equity issues of disadvantaging students who do not have access to devices. Rural teachers were incredibly creative with ChatGPT in low-tech settings (printing transcribed work, arranging peer learning around AI-generated work), but it is properly unfair to ask teachers to bridge the gap in infrastructures by working personally.

The key implications of the study are: (a) ChatGPT implementation in education in developing countries needs to focus on infrastructure, curriculum reform, policy formulation, and teacher training, rather than just provision of technology; (b) rural-urban differences in adoption capacity are too large to be addressed with the same policy; (c) equity issues are not a stop to adoption, but rather necessary pedagogical factors defining adoption policy; (d) teacher abilities and interest in ChatGPT implementation exist on both rural-urban settings; the problem lies not there however, but in institution-supporting systems.

In the case of Pakistan, the government will also have to institute policy frameworks at the government level that clarify how ChatGPT will be used, curriculum and accountability system reforms that decouple evaluation pace with the uniform pace, infrastructure and target investment in rural schools, compulsory teacher development with lifelong support and equitable protection of students who will not be disadvantaged by the use of AI. These are radical but mandatory changes. Without them, ChatGPT would still be an fringe benefit that some motivated urban teachers use every now and then, as rural students continue to be systematically excluded, even before AI-assisted learning, continuing to widen existing disparities in education.

This is because the present time, owing to the young age of ChatGPT adoption and policy structures yet to be solidified is an opportunity to develop inclusive and equitable grounding. The future of the education system in Pakistan depends on the current decisions regarding the use of ChatGPT in schools. Pakistan can make sure that ChatGPT turns into a means of inclusive learning enhancement rather than the cause of inequality by attending to rural settings, infrastructure equity, teacher preparedness, and systemic variables and combining them with technology.

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