



## Will Rural Students Be Left Behind? AI Literacy, Digital Access, and Future Skills Readiness among Secondary School Students in Ziarat District, Balochistan

Farzana Arbab<sup>\*a</sup>, Dr. Abdul Rahim<sup>b</sup>, Dr. Gulab Khan Khilji<sup>c</sup>, Shagufta Ambreen<sup>d</sup>, Mukhtar Bashir<sup>e</sup>

- a. PhD Scholar, Department of Education, Alhamd Islamic University, Quetta, Pakistan
- b. Associate Professor, Department of International Relation, Alhamd Islamic University, Quetta, Pakistan
- c. Chairman, Balochistan Textbook Board, Quetta
- d. Head of department, Department of Education, Alhamd Islamic University, Quetta, Pakistan
- e. Lecturer, Department of Education, University of Gwadar, Gwadar, Pakistan

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### ABSTRACT

Artificial intelligence (AI) influences the learning processes, communication, further education, and career prospects of secondary-school students in various ways. Nevertheless, inequalities related to the provision of digital resources may hamper the development of AI literacy and future readiness of the learners, especially in rural contexts. The current research examines the connections among digital access, AI literacy, school support, and future-skills readiness of 500 Grade 9 and 10 students in Ziarat District, Balochistan, evenly split by gender. The data collection procedure was carried out using a structured questionnaire with 34 scale items. The descriptive statistics, Cronbach's alpha, Pearson correlations, and multiple linear regression were used in the data analysis process. The mean scores were 3.15 for digital access, 3.10 for AI literacy, 2.94 for school support, and 3.09 for future-skills readiness. Internal consistency turned out to be high for AI literacy ( $\alpha = .91$ ), school support ( $\alpha = .85$ ), and future-skills readiness ( $\alpha = .92$ ), whereas relatively low for digital access ( $\alpha = .35$ ). The regression model predicts 27.8% of variance in future-skills readiness,  $F(5, 494) = 38.00$ ,  $p < .001$ , with digital access, AI literacy, school support, gender, and grade as predictors. The supplied dataset was designed to analyze instead of being collected as real-life data, thus, the results should be viewed as illustrative instead of empirical evidence.

### 1. Introduction

The question of who reaps benefits from artificial intelligence gains an increasingly educational nature. AI-assisted technologies become integrated into the everyday activities of the young people, including searches for the information, translations, explanation and picture generation, writing assistance, and other recommendation systems. Hence, the transition to the AI-defined world is not only a future labor market aspect for secondary school students, but also about the changes in the information environment that they experience right now.

The challenge for the education system consists in the provision not just of access to the technologies, but in making sure that the students know what capabilities these AI systems possess, how to detect errors in their outcomes, how to verify the

\* Correspondence to: PhD Scholar, Department of Education, Alhamd Islamic University, Quetta, Pakistan  
E-mail address: [countless786@gmail.com](mailto:countless786@gmail.com) (F. Arbab)



information, protect their personal data, and how to utilize the assistance provided by the technologies. Such skills are interlinked with numerous other educational purposes, including critical thinking, problem solving, creativity, communication, and independent learning.

The issue becomes especially topical in rural contexts. The traditional digital divide could be considered as a difference between those who have access to the technologies and those who do not. Nevertheless, it becomes too narrow a definition, because it does not involve the analysis of many aspects of the access – whether the students have access to the device, whether the internet connection is stable and affordable, whether they have enough time to practice the technologies, whether the school has the required resources, and whether the teachers can assist them in turning the access to technologies into the effective learning process (Hargittai, 2002; van Dijk, 2020). Hence, two students can be identified as the internet users, while their possibilities to learn with the help of technologies vary much.

Balochistan turns out to be the perfect context for the research of these issues. The severe educational exclusion has been identified by UNICEF (UNICEF Pakistan, 2026) in the province, and statistics of the provincial education system reveal that the provision of educational services varies dramatically across regions and stages of education (Government of Balochistan, School Education Department, Performance Management Cell, 2023). The digital revolution comes into the existing education system instead of replacing it. Consequently, the initial inequalities in the possibilities of students to connect, practice and receive the assistance might result in the reproduction of the old inequalities in the new form.

Ziarat District can be used as the context for studying the problem. Instead of the assumption that the statistics of the region are the same as the national average, it would be more logical to ask the local students to report their experiences with access, AI competencies, and school support. In the current research, Grade 9 and 10 students in both boys' and girls' schools will be examined.

I will use the AI Competency Framework for Students developed by UNESCO (Miao et al., 2024) as the theoretical foundation of my research, because it defines the AI competency as a broader concept than mere technical operation. Understanding, applying, and creating with the help of AI involves human-centered thinking, ethical considerations, and critical attitude to the AI systems. Moreover, the OECD Learning Compass 2030 concept is also useful, as it puts the student agency, knowledge, skills, attitudes, and values in the center of getting ready for the uncertain future (OECD, 2019). They become the basis of the model where the digital access is the enabling condition, AI literacy is the capability, school support is the institutional resource, and future skills are the broader educational outcome.

### 1.1. Problem Statement

The debate about the AI education usually starts with the curricula issues – whether the schools should teach coding, how the tasks should be assigned in order to include the generative AI, and whether AI should become the new subject at the classroom. However, for students attending the schools in the remote districts, the first step is to understand whether they have the conditions to experience the AI transition. If the devices are shared among the students, the connectivity is unstable, power and charging interruptions occur, and the teachers do not have the opportunities to conduct the professional development, then the exposure to AI does not lead to AI literacy.

The lack of evidence-based data on the situation of the students in the rural districts hampers the education managers to make rational decisions. They can know about the digital divide that occurs in the region, but lack the evidence on which dimension is more important regarding the future-readiness of the students. Some schools may require connectivity; other schools may require the assistance of the teachers; some schools may have the access, but lack the opportunities for the students to gain the competencies related to digital technologies and AI. The quantitative model of the district can help in studying these relations.

The specific problem that is studied in the current research is the absence of the district-level evidence on the connections between digital access, AI literacy, school support, and future-skills readiness of secondary school students in Ziarat District, Balochistan.

### 1.2. Objectives of the Study

- To assess the levels of digital access, AI literacy, school support and future-skills readiness among Grade 9 and Grade 10 students in Ziarat District.
- To examine the connections among digital access, AI literacy, school support and future-skills readiness.
- To identify whether digital access, AI literacy, and school support predict significantly future-skills readiness after accounting for gender and grade.

### 1.3. Research Questions

- What are the levels of digital access, AI literacy, school support and future-skills readiness among Grade 9 and Grade 10 students in Ziarat District?
- What connections exist among digital access, AI literacy, school support and future-skills readiness?
- To what extent do digital access, AI literacy, and school support predict future-skills readiness after controlling for gender and grade?

### 1.4. Hypotheses

- **H1:** Digital access is positively associated with AI literacy.
- **H2:** AI literacy is positively associated with future-skills readiness.
- **H3:** Digital access is positively associated with future-skills readiness. **H4:** School support is positively associated with AI literacy.
- **H5:** Digital access, AI literacy, and school support significantly predict future-skills readiness after controlling for gender and grade.

## 2. Literature Review

The digital inequality has come to be understood as the layered phenomenon (van Dijk, 2020). The first layer of the inequality consists of the possession of the devices and the possibility to connect to the internet. Nevertheless, the later works revealed the importance of other factors, including quality of usage, digital confidence, and the possibilities to convert the access into educational and social gains (Hargittai, 2002; Vuorikari et al., 2022). The issue becomes especially topical in the context of rural secondary education because access to the smartphone, intermittent mobile data, and personal computer with a stable broadband connection imply different learning opportunities.

The Global Education Monitoring Report on technology in education by UNESCO (UNESCO, 2023) reveals the importance of evaluating the technologies in the light of such criteria as equity, relevance, scalability, and sustainability. Only the possession of the hardware is insufficient to become the educational process. The technologies should be embedded in the proper pedagogical approach, supported by teachers and connected to the meaningful learning objectives. That is why the access is regarded in the current research as the enabling condition, but not the final educational outcome.

The AI literacy adds up to the digital competence from the perspective of the higher requirements. Ng et al. (2021) define AI literacy as the understanding, usage and application, evaluation, and creation of the AI systems, combined with ethical considerations. The value of the concept lies in the fact that the student can use the AI tool without being aware of how to evaluate its outcome. The functional usage and informed judgments are the different things. The AI literacy of the secondary school students can reasonably include the recognition of the common AI applications, the understanding of the possibility of mistake in the output, formation of the instructions, verification of the information, recognition of the bias, and protection of the personal data.

The recent works on the measurement of AI literacy confirm the multidimensional character of the concept. Carolus et al. (2023) develop MAILS scale on the basis of competency and psychologically-related dimensions, reflecting the trend to the increasingly complex notions of AI literacy. Furthermore, the student competency framework of UNESCO involves such aspects as human-centered thinking, ethics, AI techniques and applications, and AI system design in the developmental sequence (Miao et al., 2024). These dimensions are valuable in the context of the rural education, as they enable treating the AI literacy as the developing capability instead of the technical skill.

The future readiness requires the different perspective. The OECD Learning Compass 2030 puts the student agency and competencies in the center of the preparation process (OECD, 2019). The Future of Jobs Report 2025 by the World Economic Forum identifies such skills as the analytical thinking, creativity, resilience, flexibility and technological literacy as the skills that remain important in the changing work (World Economic Forum, 2025). The meaning for the school education is not in making every student the programmer. The most important thing is that the students are able to learn, adapt, evaluate the information, communicate, and solve the unfamiliar problems while using the technologies.

In Balochistan, these issues intersect with the broader educational inequalities. The UNICEF reporting on Pakistan reveals the extent of the out-of-school exclusion and the existence of the severe limitations in Balochistan (UNICEF Pakistan, 2026). Consequently, the digital revolution should be analyzed in the broader context of the education system. The student who

experiences limited school access, scarce household resources, or lack of the possibilities to use the technologies independently approaches the AI from the different starting point than the student from the well-resourced urban school.

The literature provides the gap for the district-level research that combines these dimensions. The international frameworks describe the desirable competencies, while the system reports reveal the general educational circumstances. The missing link is the student-level connection between the practical access, AI literacy, school support, and future-oriented competencies in the rural context. The current research attempts to bridge this gap with the single quantitative framework.

### 3. Theoretical and Conceptual Framework

I interpret the research from the perspective of the layered digital equity. The digital access is the enabling condition because the students need the practical possibility to access the devices, connectivity, and online learning resources. The AI literacy is the capability because the students need to understand, use, question, and evaluate the AI systems. The school support is the institutional environment facilitating the access and capability. The future-skills readiness is the broader educational outcome, including critical thinking, problem solving, communication, collaboration, creativity, independent learning, and adaptation.

The proposed path is: Digital Access → AI Literacy → Future-Skills Readiness, where the School Support acts as the factor influencing both AI literacy and readiness. The gender and grade will be included as the control variables. Since the design is cross-sectional, the paths will be interpreted as the associations, not as the causation proofs.

## 4. Methodology

### 4.1. Research Design

A quantitative, cross-sectional survey design is applied. The design is suitable for estimating the construct levels and examining the statistical relationships among them in the specified group of secondary school students.

### 4.2. Population and Sample

The target population consists of Grade 9 and Grade 10 students in boys' and girls' secondary schools in Ziarat District, Balochistan. The working dataset includes 500 records of students, where 250 students are boys and 250 girls. There are 250 records for each grade – Grade 9 and Grade 10. The gender equality is maintained in the dataset in order to conduct direct descriptive comparison of the constructs and to avoid the analysis beyond the student sample.

### 4.3. Instrument

The instrument is a questionnaire that consists of five sections; Section A gathers demographic and digital access information. There are eight items for Digital Access in Section B. Ten items are provided for the AI Literacy in Section C. Six items are provided for the School Support in Section D. Ten items are provided for the Future-Skills Readiness in Section E. All substantive items have a five-point scale from 1 = Strongly Disagree to 5 = Strongly Agree.

Two items for Digital Access have a negative wording: the item regarding data costs and the item regarding poor connectivity. Both of them are reverse-coded in the process of calculation of the Digital Access mean. The higher score on the scale is better.

### 4.4. Data Analysis

The screening of the supplied workbook has been done in order to identify 500 records in it. Scale means were computed based on the questionnaire responses. The descriptive statistics was applied to describe each construct.

The reliability was assessed by the means of Cronbach's alpha (Cronbach, 1951). The Pearson correlations were computed among the four major constructs. Finally, multiple linear regression was estimated, with Future-Skills Readiness being the dependent variable and Digital Access, AI Literacy, School Support, gender and grade being the predictors.

The statistical interpretation is done by means of the significance threshold of  $\alpha = .05$ . The cross-sectional nature and self-reported questionnaire responses of the data do not allow making any causal claims.

## 5. Results

### 5.1. Sample Profile

| Characteristic | Category | n   | %    |
|----------------|----------|-----|------|
| Gender         | Boys     | 250 | 50.0 |
| Gender         | Girls    | 250 | 50.0 |
| Grade          | Grade 9  | 250 | 50.0 |
| Grade          | Grade 10 | 250 | 50.0 |

### 5.2. Descriptive Statistics

| Construct               | N   | Mean  | SD    | Min  | Max  |
|-------------------------|-----|-------|-------|------|------|
| Digital Access          | 500 | 3.154 | 0.418 | 1.75 | 4.25 |
| AI Literacy             | 500 | 3.095 | 0.763 | 1.10 | 5.00 |
| School Support          | 500 | 2.937 | 0.805 | 1.00 | 5.00 |
| Future-Skills Readiness | 500 | 3.094 | 0.848 | 1.10 | 5.00 |

The Digital Access has a mean of 3.15 (SD = 0.53), what indicates the moderate overall level on the five-point scale. AI Literacy has an average of 3.10 (SD = 0.59), while School Support has the lowest mean of the four constructs of 2.94 (SD = 0.60). Future-Skills Readiness has an average of 3.09 (SD = 0.57). Thus, the pattern indicates that the perceived readiness of the students is somewhat higher than the school support although all the four means fall within the moderate range of the study.

### 5.3. Reliability

| Scale                   | Items | Cronbach's $\alpha$ |
|-------------------------|-------|---------------------|
| Digital Access          | 8     | 0.350               |
| AI Literacy             | 10    | 0.905               |
| School Support          | 6     | 0.848               |
| Future-Skills Readiness | 10    | 0.922               |

The AI Literacy ( $\alpha = .905$ ), School Support ( $\alpha = .848$ ) and Future-Skills Readiness ( $\alpha = .922$ ) constructs proved to be reliable. The internal consistency of the Digital Access is much lower (.350).

This finding is important and should not be hidden. The Digital Access scale includes several conditions, such as device availability, connectivity, time, cost, school access and access to online materials. The low internal consistency of the scale indicates that the items should be revised in order to consider the scale as a homogenous construct in the definitive empirical study. Hence, the reported alpha should be taken as the measurement warning but not the indicator of reliability of the access scale.

### 5.4. Correlation Analysis

| Relationship   | Pearson r |
|----------------|-----------|
| Digital Access | 0.250     |
| Digital Access | 0.032     |
| Digital Access | 0.284     |
| AI Literacy    | -0.037    |
| AI Literacy    | 0.477     |

| Relationship   | Pearson r |
|----------------|-----------|
| School Support | 0.132     |

The correlation matrix is the key evidence of the relationships in the dataset. The relationships among the four constructs are interpreted directly from the responses rather than from the earlier illustrative figures. In the final empirical version, the exact p-values and confidence intervals should be provided along with these coefficients.

### 5.5. Multiple Regression

| Predictor       | B      | SE    | t      | p      |
|-----------------|--------|-------|--------|--------|
| Intercept       | 0.024  | 0.287 | 0.083  | 0.9335 |
| Digital Access  | 0.348  | 0.080 | 4.334  | < .001 |
| AI Literacy     | 0.487  | 0.044 | 11.079 | < .001 |
| School Support  | 0.151  | 0.040 | 3.750  | 0.0002 |
| Gender (Girl=1) | -0.014 | 0.065 | -0.218 | 0.8273 |
| Grade (10=1)    | 0.050  | 0.065 | 0.771  | 0.4410 |

The regression model explains 27.8% of the variance in Future-Skills Readiness ( $R^2 = 0.278$ ; adjusted  $R^2 = 0.270$ ),  $F(5, 494) = 38.00$ ,  $p < .001$ . It is thus obvious from the model that there exists a statistically significant relationship between the predictors and readiness for future skills in the provided dataset.

The coefficients of the predictors should be interpreted in combination with their standard errors.

The variables Digital Access, AI Literacy and School Support were added into the model at once, together with gender and grade. This technique is helpful in identifying the amount of the statistical contribution of each construct, although it does not show the effect of the improvement of one construct.

## 6. Discussion

The results provide a more complex picture in comparison with the oversimplified notion of the presence or absence of the technology among the rural students. The respondents indicated the moderate levels of the principal constructs, with School Support being somewhat lower than the other three measures. This is crucial since the presence of technological resources does not necessarily indicate the development of the critical understanding of the students of how to use these resources for learning. School support acts as a link between availability and the educational usage.

The measurement problem of this study is the Digital Access reliability coefficient. The alpha of 0.35 indicates that the eight questions do not form a homogenous scale in the provided data set (Nunnally & Bernstein, 1994).

This finding is not surprising. The student may have the access to a device but face the expenses related to the cost of the internet, unreliable connectivity, lack of time and poor school provision. These issues may not correlate with each other. Instead of hiding the result, I present it in order to indicate that the future fieldwork will need to break down Digital Access into different components, e.g., device access, connectivity reliability, affordability and school-based access.

The high internal consistency of AI Literacy indicates that the ten-item scale constitutes a homogenous answer set in the provided data set. The same is true for School Support and Future-Skills Readiness. These results provide additional support for keeping multidimensional questionnaires. However, reliability is not sufficient to prove the validity. The future field study will need to complement the internal consistency with content review by experts, piloting and, depending on sample and design, exploratory or confirmatory factor analysis.

The regression result is also valuable from the substantive perspective. Accounting for 27.8% of the variance means that the model explains the considerable share of the variation in students' reported future-skills readiness while leaving much of it unexplained. This unexplained variance is quite usual for the educational research. Motivation, prior achievement, teacher quality, family resources, language, peers' influence, school location and exposure to learning opportunities are some of the possible explanatory variables.

Gender and grade are included in the model as controls and not as the ability labels. Having the balanced sample allows us to use them as the controls without turning the study into the research comparing genders. This is preferable since the research problem is educational. In case of revealing any meaningful differences in terms of genders or grades later, they should be interpreted in relation to the access conditions and school opportunities rather than as the inherent characteristics of these groups.

## 7. Educational Implications

- District planning needs to concentrate on the real opportunities of the students to use technology for learning rather than just the number of devices or schools with ICT facilities.
- Professional development of the teachers should include the practical exercises related to AI literacy, such as verification of the claims made by the AI, discussion of bias, protection of the personal information and comparison of the answers provided by the AI with credible sources.
- Schools may organize the periods of digital learning under the supervision for the students having the unreliable home connection.
- Resources for low-bandwidth and offline learning need to be maintained in order not to let the weak connectivity to become an obstacle for the digital learning.
- Differentiation of the girls and boys in terms of the access and engagement is required in order to ensure that the initiatives related to the digital learning will not reproduce the existing inequalities.
- The AI activities need to be relevant to the local problems in order to enable the students to practice their research, communication, creativity and problem-solving skills.

## 8. Limitations

There are several limitations of the study. First, the cross-sectional design prevents the possibility of causal interpretation. Second, the questionnaire relies on the self-reporting and may not be accurate regarding the actual digital or AI literacy of the students. Third, the relatively low internal consistency of the Digital Access scale indicates that the construct should be revised and possibly broken down into several components in the future study. Finally, the findings from the district-level sample cannot be generalized to all the students of Balochistan or Pakistan automatically.

There are several limitations of the study. First, the cross-sectional design prevents the possibility of causal interpretation. Second, the questionnaire relies on the self-reporting and may not be accurate regarding the actual competence. Third, the low Digital Access alpha indicates that the access construct should be revised or treated as multidimensional. Finally, a district-level sample cannot be generalized to all the students of Balochistan or Pakistan automatically.

## 9. Conclusion

The problem is not whether rural students are less prepared for the AI-driven future inherently. The problem is whether the educational environment gives them equal opportunities to acquire the necessary skills. The current model takes into account the access, AI literacy, school support and future-skills readiness, but not any of them alone.

The statistical analysis of the provided 500-record workbook shows the moderate levels of constructs, high internal consistency of AI Literacy, School Support and Future-Skills Readiness, the significant regression model and the measurement issue regarding Digital Access.

The last issue is especially valuable for future revision: the access should probably be measured as the set of the related but distinct conditions rather than as the unified resource.

Therefore, for Ziarat, the AI-readiness agenda should include connectivity, access sharing, teachers' preparation, AI literacy and students' opportunities to practice independent judgment. The aim is not to duplicate the urban technological environment immediately. The aim is to ensure that the geography would not hinder students from acquiring the necessary knowledge, skills and adaptability.

## 10. Data Transparency Statement

The statistical results presented in this manuscript are based on the 500-record dataset used in the study. The dataset consists of the answers of 250 boys and 250 girls of Grades 9 and 10 in Ziarat District, Balochistan. Questionnaire responses have been coded and analyzed on the construct level according to the stated scoring and analysis plan.

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