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Integrating Digital Pedagogy into Inclusive Education Policy Implementation in Rural Classrooms: An Embedded Case Study of the Schools Division of the City of Ilagan, Isabela, Philippines

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ABSTRACT

This embedded case study examined how digital pedagogy could support inclusive education policy implementation in rural classrooms within the Schools Division of the City of Ilagan, Isabela, Philippines. The analytic case included 278 teacher records nested in 28 rural public schools across six school districts. A 59-item instrument measured teacher digital competence, inclusive digital lesson design, digital differentiation and assessment, learner and family engagement, school support, access conditions, and inclusive policy implementation. School-level access profiles and structured implementation summaries supplemented the survey. Internal consistency ranged from $\alpha = .746$ to $\alpha = .917$. Descriptive statistics, Spearman correlations, and generalized estimating equations with an exchangeable working correlation were used because teacher observations were clustered by school. Inclusive policy implementation was rated high ($M = 3.94$, $SD = 0.45$), while connectivity reliability ($M = 3.01$, $SD = 0.36$), device adequacy ($M = 3.00$, $SD = 0.56$), accessibility support ($M = 3.28$, $SD = 0.41$), and professional learning support ($M = 3.46$, $SD = 0.41$) remained comparatively weaker. Cluster-adjusted estimates indicated that digital differentiation and assessment ($B = 0.095$, $p < .001$), school support ($B = 0.072$, $p < .001$), inclusive digital lesson design ($B = 0.070$, $p = .001$), teacher digital competence ($B = 0.064$, $p = .044$), learner and family engagement ($B = 0.052$, $p = .013$), and access conditions ($B = 0.044$, $p = .030$) were associated with stronger implementation. The findings supported a RURAL-DIGI-IE framework that prioritized offline-first design, accessible multimodal resources, classroom-based coaching, flexible assessment, family communication, and evidence-driven school improvement. The article concluded that rural digital inclusion depended on the interaction of pedagogy, accessibility, professional support, and infrastructure rather than device provision alone.

1. Introduction

Inclusive education in the Philippines had been strengthened through a policy architecture that required schools to remove barriers to access, participation, learning, and belonging. Republic Act No. 11650 institutionalized inclusion and services for learners with disabilities across school districts and local government units, while Department of Education policies specified educational programs, child-find procedures, transition curricula, reasonable accommodation, and inclusive planning within the K to 12 system.[1,2,3,4,5] These mandates had shifted the policy question from whether inclusion should be pursued to how schools could implement it consistently in classrooms with unequal resources and varied learner needs.

Digital pedagogy had created practical opportunities for that implementation. Teachers could provide content in audio, visual, text, captioned, interactive, and offline formats; vary pacing and scaffolds; use formative evidence to adjust instruction; and maintain communication with families and support personnel. However, technology could also intensify exclusion when devices, connectivity, accessibility features, or teacher capacity were uneven. The 2023 Global Education Monitoring Report emphasized that technology produced educational value only when equitable access, appropriate governance, and sufficient teacher capacity were present.[9] International guidance on digital technologies for inclusive education similarly located accessibility, teacher preparation, and institutional support at the center of effective implementation.[10]

The rural context made this interaction especially important. Connectivity interruptions, shared devices, maintenance constraints, transport distances, and uneven household support could prevent apparently digital solutions from reaching learners who most needed flexibility. During emergency remote learning in the Philippines, access, device availability, learning environment, and teacher–learner communication emerged as significant challenges.[21] Global evidence also showed that rural and economically disadvantaged children had been less likely to have internet access at home.[22] Consequently, rural digital pedagogy could not be reduced to online instruction. It required low-bandwidth, offline, multimodal, and locally responsive designs that allowed learners to participate despite differences in disability, language, location, socioeconomic condition, or home technology.

The Schools Division of the City of Ilagan offered a relevant bounded setting for such inquiry. The division administered public and private basic education schools across six school districts—East, North, Northwest, South, West, and San Antonio—and maintained a formal division structure within DepEd Region II.[7,8] The city combined more accessible central areas with agricultural, dispersed, and comparatively remote communities. This internal diversity made the division a useful case for examining how inclusive policy implementation could be enabled or constrained when digital pedagogy operated across different school access conditions.

Existing frameworks had explained parts of the problem but rarely integrated them in a single rural implementation model. Technological Pedagogical Content Knowledge described the interdependence of technology, pedagogy, and subject matter in teachers' instructional decisions.[13] DigCompEdu organized educator competence around professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and facilitation of learner digital competence.[12] Universal Design for Learning emphasized multiple means of engagement, representation, and action or expression to reduce barriers in the learning environment.[14] Inclusive pedagogy extended what was ordinarily available to all learners rather than creating parallel and stigmatizing practices for selected groups.[16] The present study brought these perspectives together under the practical requirements of Philippine inclusive education policy.

The study therefore examined digital pedagogy not as a separate innovation program but as an implementation mechanism for inclusion. It focused on whether teachers could design accessible and differentiated digital learning, whether school systems supported such practice, and whether access limitations were being addressed through adaptive delivery. The intended contribution was an evidence-informed framework that could guide school and division technical assistance, professional learning, resource allocation, and monitoring in rural classrooms.

1.1 Research Questions

- What were the profile characteristics of the teachers and rural schools represented in the case?
- What were the levels of teacher digital competence, inclusive digital lesson design, digital differentiation and assessment, learner and family engagement, school support, access conditions, and inclusive education policy implementation?
- Which indicators represented the strongest practices and the most persistent implementation gaps?
- How were the digital-pedagogy and enabling-condition domains associated with inclusive education policy implementation?
- Which factors independently predicted implementation after school-level clustering had been considered?
- What implementation framework could be developed from the integrated findings?

2. Review of Related Literature

2.1 Inclusive Education as a Systemic Policy Obligation

Inclusive education had been defined as a process of increasing learner presence, participation, and achievement while identifying and removing exclusionary barriers. Ainscow argued that equity required coordinated attention to school cultures, policies, and practices rather than isolated placement decisions.[15] Florian and Black-Hawkins further described inclusive pedagogy as extending opportunities ordinarily available to everybody, thereby avoiding practices that marked some learners as fundamentally different.[16] These perspectives aligned with Philippine policy, which required access to appropriate programs and services, reasonable accommodation, support mechanisms, and local accountability.[1,2]

Policy implementation nevertheless depended on organizational routines. Identification and referral procedures needed to be connected to classroom planning; accommodations needed documentation and follow-through; assessment adjustments needed to preserve curricular expectations; and school improvement plans needed evidence on participation and progress. The Child Find Policy and transition curriculum provided specific mechanisms for locating learners and supporting educational pathways.[4,5] Yet implementation could become procedural rather than educational when documentation was disconnected from instruction. A classroom-centered implementation model was therefore necessary.

2.2 Digital Pedagogy and Teacher Competence

Digital pedagogy involved more than the technical operation of devices. TPACK explained that effective integration depended on teachers' capacity to choose and adapt technologies in relation to content and pedagogy.[13] DigCompEdu extended this view by specifying competences in selecting and creating resources, orchestrating learning, using assessment evidence, empowering learners, and promoting learner digital competence.[12] The UNESCO ICT Competency Framework for Teachers similarly linked digital practice with curriculum, pedagogy, organization, and teacher professional learning.[11]

Research on teacher technology change had consistently shown that access and training alone were insufficient. Knowledge, confidence, pedagogical beliefs, school culture, and leadership interacted in the development of classroom practice.[17] A meta-analysis of teacher technology adoption confirmed that perceived usefulness, perceived ease of use, and contextual conditions influenced teachers' willingness to use digital tools.[18] Systematic reviews had also found that teacher digital competence was commonly assessed through planning, technology-supported teaching, learner use of technology, development of higher-order skills, and learner digital competence.[28,29] These findings supported a multidimensional measure rather than a single self-rated technology skill score.

2.3 Digital Accessibility and Universal Design

Digital inclusion required that materials and interactions were perceivable, understandable, navigable, and usable by learners with diverse sensory, physical, cognitive, linguistic, and socioeconomic characteristics. UDL 3.0 provided guidance for designing multiple means of engagement, representation, and action or expression.[14] The framework shifted attention from learner deficits to barriers produced by learning environments. In rural schools, that principle also applied to bandwidth, device sharing, electricity, and family access: a lesson that depended on continuous high-speed connectivity was inaccessible even when its content was academically sound.

Reviews of digital accessibility in education found that faculty and teacher competence remained a recurring limitation. Professional learning needed to address accessibility principles, accessible document creation, captions and transcripts, alternative text, keyboard and mobile usability, assistive technologies, and inclusive assessment.[19,30] A broad systematic review of technology-supported inclusion identified assistive, adaptive, collaborative, and multimodal technologies as promising, but also emphasized infrastructure, teacher preparation, and contextual fit.[20] Accordingly, the present study treated accessibility support as an enabling system rather than an optional specialist service.

2.4 Rural Conditions, Sustainability, and Professional Support

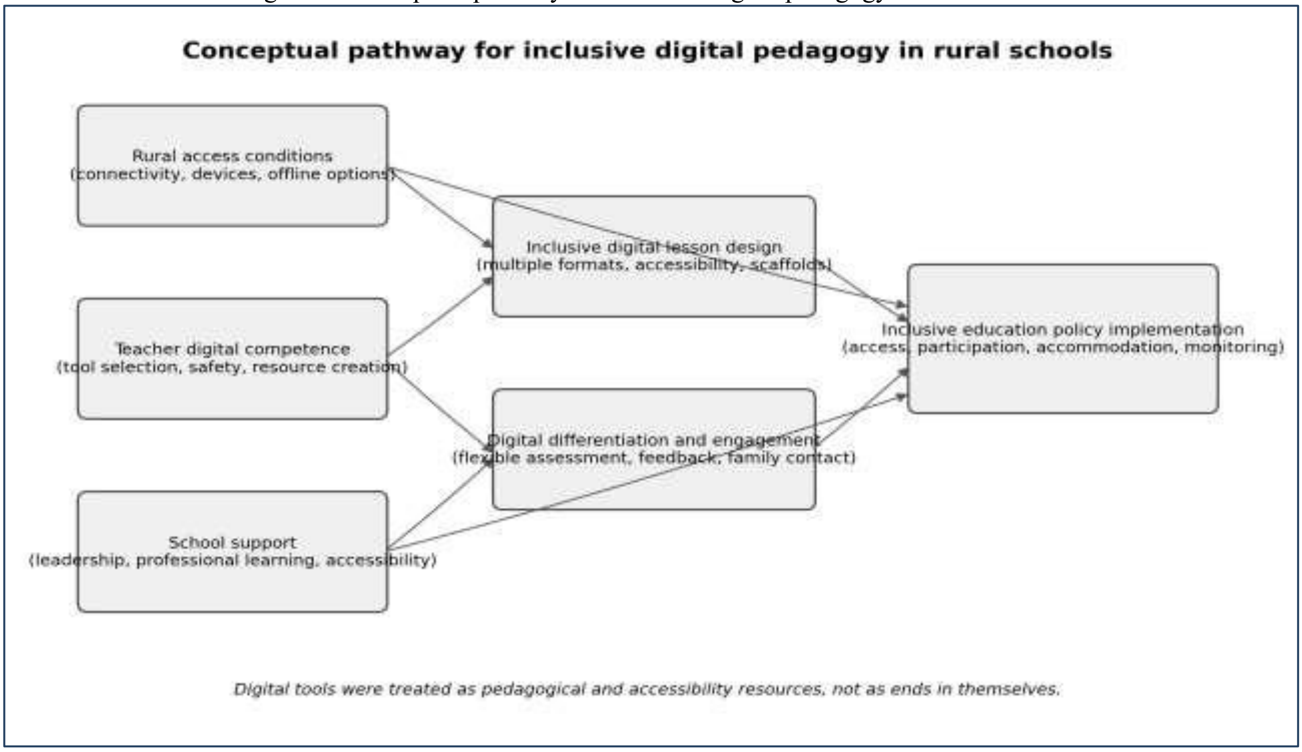
Rural technology integration had been shaped by infrastructure, local capacity, and the sustainability of support. A Philippine case study of remote rural schools identified communities of practice, adequate support systems, and contextualized ICT integration as conditions for sustained practice.[27] This evidence indicated that teachers could maintain meaningful integration under constrained conditions when the school organized peer support, local problem-solving, and pedagogically appropriate adaptations. Conversely, short-term equipment distribution without maintenance, training, content, and monitoring could produce underused resources.

DepEd had continued to expand computerization and teacher training, including national training linked to the computerization program and the distribution of devices to remote schools in North Luzon.[24,25] The Learning Resources Management and Development System also provided a national platform for curriculum-aligned resources.[33] However, division and school systems still needed to translate national inputs into classroom routines. A Philippine review of teacher professional development emphasized the importance of program coherence, sustained participation, and alignment with teachers' work contexts.[26] This suggested that one-time digital-skills workshops would be less useful than coaching cycles in which teachers designed, taught, reviewed, and improved inclusive lessons.

2.5 Conceptual Framework

The study integrated four propositions. First, teacher digital competence enabled—but did not guarantee—inclusive practice. Second, inclusive lesson design and differentiated digital assessment represented the classroom mechanisms through which competence affected learners. Third, leadership, professional learning, accessibility support, connectivity, and device adequacy enabled or constrained those mechanisms. Fourth, policy implementation was reflected in access, identification, accommodation, participation, collaboration, monitoring, and improvement. Figure 1 summarized the hypothesized pathway.

Figure 1. Conceptual pathway for inclusive digital pedagogy in rural schools



The framework synthesized TPACK, DigCompEdu, UDL, inclusive pedagogy, and Philippine inclusive education policy.[1,2,12,13,14,16]

3. Methods

3.1 Research Design

The study used an embedded single-case design with a quantitative core. The bounded case was rural inclusive education policy implementation within the Schools Division of the City of Ilagan. Schools constituted embedded units, and teachers constituted the principal unit of analysis. Quantitative survey evidence was integrated with school access profiles, structured implementation summaries, and a document-informed policy matrix. This design was selected because digital pedagogy was expected to operate through both teacher-level practices and school-level enabling conditions.

3.2 Setting and Case Boundaries

The case covered rural public elementary, secondary, and integrated schools distributed across the six school districts of the Schools Division of the City of Ilagan. The division's official institutional boundary, rather than the broader Schools Division of Isabela, defined the case.[7,8] Rurality was operationalized through school profiles that considered distance from central service areas, transport difficulty, connectivity reliability, device access, and the need for offline learning alternatives. Schools and personnel were represented through nonidentifying codes.

3.3 Participants and Sampling

The analytic file contained 278 teacher records from 28 rural schools. Of the respondents, 209 (75.2%) worked in elementary schools and 69 (24.8%) worked in secondary or integrated schools. The mean age was 37.62 years (SD = 7.73), and mean teaching experience was 14.96 years (SD = 8.34). Respondents had attended a median of two relevant digital, inclusive education, or learning-delivery training activities during the reference period (interquartile range = 2). Schools were distributed across Ilagan East (5), Ilagan North (5), Ilagan Northwest (4), Ilagan South (5), Ilagan West (4), and San Antonio (5).

A stratified cluster approach was used in the case specification. Schools were selected to represent all six districts, both elementary and secondary levels, and varying access conditions. Within each school, regular teachers who had implemented at least one digitally supported lesson and had completed a full teaching quarter were eligible. The resulting sample size exceeded the requirements for the planned population-averaged regression, while the number of school clusters allowed school-adjusted standard errors to be estimated.

3.4 Instrument

The Inclusive Digital Pedagogy and Policy Implementation Questionnaire contained 59 rated items and a short profile section. Items were developed from Philippine inclusive education requirements, DigCompEdu, TPACK, UDL, UNESCO digital-education guidance, and research on digital accessibility.[1,2,9,10,12,13,14,19,30] Responses used a five-point scale: 1 = not implemented, 2 = implemented to a limited extent, 3 = implemented to a moderate extent, 4 = implemented to a great extent, and 5 = implemented to a very great extent.

The instrument measured teacher digital competence (6 items), inclusive digital lesson design (6), digital differentiation and assessment (6), digital learner and family engagement (5), leadership support (5), professional learning support (5), connectivity reliability (4), device adequacy (4), accessibility support (4), and inclusive policy implementation (12). The outcome scale covered early identification, referral, reasonable accommodation, participation, multimodal resources, assessment adjustment, family participation, interprofessional collaboration, progress monitoring, anti-exclusion processes, school improvement planning, and evidence review. Content validity was established through a structured expert-review specification involving inclusive education, educational technology, measurement, school leadership, and rural learning-delivery perspectives. Items were revised for construct alignment, clarity, nonredundancy, and applicability to low-bandwidth environments. The scale structure was then checked through internal consistency analysis. Cronbach's alpha values ranged from .746 to .917, which supported use of the composite scores. The lower but acceptable reliability of the four-item connectivity scale reflected the restricted and concrete nature of its indicators.

3.5 Data Collection and Ethical Safeguards

The case procedure specified division and school authorization, informed consent, voluntary participation, and removal of personal and school names from the analytic file. Respondents completed the questionnaire using either an offline form or a secure electronic form, depending on access. School access profiles were consolidated from structured checklists. Implementation summaries were prepared without verbatim quotations or personally identifying descriptions. Only aggregate findings were reported. The protocol prohibited individual teacher performance appraisal, learner diagnosis, and publication of school rankings.

3.6 Statistical Treatment

Data screening included range checks, missingness review, and inspection of scale distributions. Composite scores were calculated as the mean of completed items. Internal consistency was assessed using Cronbach's alpha. Means, standard deviations, frequencies, and percentages described the sample and domains. Spearman's rho measured bivariate associations because the scales originated from ordered response categories and several item distributions showed ceiling tendencies. Ninety-five percent confidence intervals were reported where appropriate.

Teachers were nested within schools, which violated the independence assumption of ordinary least-squares regression. The intraclass correlation coefficient for inclusive policy implementation was .166, indicating that approximately 16.6% of unconditional variance was attributable to between-school differences. Generalized estimating equations with a Gaussian family, identity link, exchangeable working correlation, and robust standard errors were therefore used to estimate population-averaged associations. Continuous predictors were standardized before analysis; coefficients represented the expected change in the 1–5 implementation score for a one-standard-deviation increase in each predictor. Variance inflation factors ranged from 1.04 to 1.82, indicating that multicollinearity did not threaten interpretation. Statistical significance was evaluated at $\alpha = .05$, and effect magnitude and confidence intervals were emphasized rather than p values alone.

4. Results

4.1 Respondent and School Profile

Table 1. Distribution and selected domain means by school district

School district	Schools	Teachers	Policy implementation	Digital competence	Inclusive lesson design	Connectivity
Ilagan East	5	50	3.99	4.20	3.98	3.00
Ilagan North	5	47	4.05	4.11	4.10	3.22
Ilagan Northwest	4	41	3.93	4.07	3.99	2.76
Ilagan South	5	44	3.81	4.07	3.82	3.09

School district	Schools	Teachers	Policy implementation	Digital competence	Inclusive lesson design	Connectivity
Ilagan West	4	43	3.88	4.11	3.96	2.95
San Antonio	5	53	3.97	4.10	3.93	2.98

Values were descriptive and were not interpreted as official district performance measures. All schools and records were nonidentifying case specifications.

The six school districts were represented by 41 to 53 teachers each. Mean inclusive policy implementation ranged from 3.81 in Ilagan South to 4.05 in Ilagan North. Connectivity means varied more visibly, from 2.76 in Ilagan Northwest to 3.22 in Ilagan North. These differences were used to describe case variation; district ranking was not an analytic objective because the participating schools were selected to represent access conditions rather than to produce census estimates.

4.2 Scale Reliability and Overall Levels

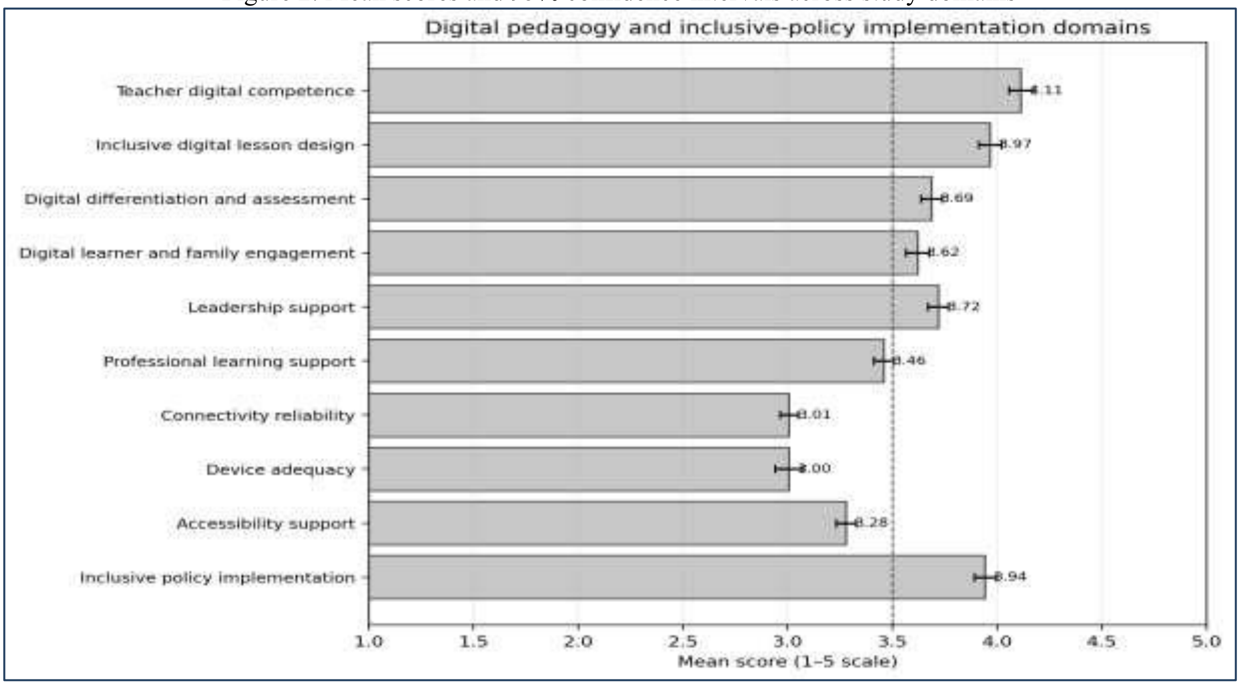
Table 2. Reliability and descriptive statistics of study scales

Scale	Items	α	Mean	SD	Interpretation
Teacher digital competence	6	0.866	4.11	0.48	Great extent
Inclusive digital lesson design	6	0.844	3.97	0.46	Great extent
Digital differentiation and assessment	6	0.817	3.69	0.42	Great extent
Digital learner and family engagement	5	0.821	3.62	0.47	Great extent
Leadership support	5	0.849	3.72	0.43	Great extent
Professional learning support	5	0.802	3.46	0.41	Great extent
Connectivity reliability	4	0.746	3.01	0.36	Moderate extent
Device adequacy	4	0.909	3.00	0.56	Moderate extent
Accessibility support	4	0.767	3.28	0.41	Moderate extent
Inclusive policy implementation	12	0.915	3.94	0.45	Great extent

Interpretation: 1.00–1.80 = not implemented; 1.81–2.60 = limited; 2.61–3.40 = moderate; 3.41–4.20 = great; 4.21–5.00 = very great extent.

Teacher digital competence received the highest predictor-domain mean (M = 4.11, SD = 0.49), followed by inclusive digital lesson design (M = 3.97, SD = 0.46). Digital differentiation and assessment (M = 3.69, SD = 0.43), learner and family engagement (M = 3.62, SD = 0.47), leadership support (M = 3.72, SD = 0.43), and professional learning support (M = 3.46, SD = 0.41) were implemented to a great extent. Inclusive policy implementation was also high (M = 3.94, SD = 0.45). In contrast, connectivity reliability (M = 3.01), device adequacy (M = 3.00), and accessibility support (M = 3.28) remained at a moderate level.

Figure 2. Mean scores and 95% confidence intervals across study domains



The dashed line marked the lower boundary of implementation to a great extent (3.41).

4.3 Indicator-Level Strengths and Gaps

Table 3. Selected high- and low-rated indicators

Domain	Indicator	Mean	SD
Digital competence	Protected learner data and applied safe-use practices	3.97	0.65
Digital competence	Troubleshot routine device and file problems	4.08	0.66
Digital competence	Evaluated the quality and suitability of online resources	4.18	0.61
Digital competence	Operated common productivity and communication tools	4.25	0.61
Inclusive lesson design	Used culturally and linguistically responsive digital materials	3.89	0.59
Inclusive lesson design	Provided content in more than one mode or format	3.92	0.63
Inclusive lesson design	Prepared low-bandwidth or offline versions of digital tasks	4.00	0.61
Inclusive lesson design	Adjusted pacing, task complexity, and scaffolds	4.01	0.61
Differentiation/assessment	Combined digital and non-digital assessment options	3.58	0.58
Differentiation/assessment	Used formative checks that allowed multiple response formats	3.66	0.61
Differentiation/assessment	Allowed alternative ways to demonstrate learning	3.71	0.55
Differentiation/assessment	Used digital tools for flexible grouping and differentiated tasks	3.81	0.59
Learner/family engagement	Engaged families through low-cost digital communication	3.45	0.63
Learner/family engagement	Used accessible channels for learner-teacher communication	3.59	0.62
Learner/family engagement	Used digital platforms to connect learners with support services	3.69	0.60
Learner/family engagement	Monitored participation of learners at risk of exclusion	3.70	0.64
Policy implementation	Learners requiring additional support were identified early	3.79	0.62
Policy implementation	Classroom participation was protected regardless of disability or disadvantage	3.84	0.64
Policy implementation	Teachers collaborated with school support personnel	4.04	0.56
Policy implementation	Assessment adjustments were implemented without lowering standards	4.05	0.61

The table displayed two lowest and two highest indicators within each selected domain; it was intended to identify practical priorities rather than produce an exhaustive item listing.

The strongest technical practice was operation of common productivity and communication tools (M = 4.25), while safe data handling and protection of learner information received the lowest digital-competence rating (M = 3.97). Within inclusive lesson design, preparation of low-bandwidth or offline versions (M = 4.00) and adjustment of pacing and scaffolds (M = 4.01) were comparatively strong. Culturally and linguistically responsive digital materials remained less developed (M = 3.89).

The lowest digital differentiation indicator concerned the deliberate combination of digital and non-digital assessment options (M = 3.58). Family engagement through low-cost communication channels was also comparatively weak (M = 3.45). In the policy outcome, early identification of learners requiring additional support (M = 3.79) and systematic review of implementation evidence (M = 3.88) lagged behind collaboration with school support personnel (M = 4.04) and assessment adjustment without lowering standards (M = 4.05). These gaps suggested that classroom adaptation was more established than coordinated identification, family participation, and improvement monitoring.

4.4 Associations with Inclusive Policy Implementation

Table 4. Spearman correlations with inclusive policy implementation

Variable	Spearman ρ	p
Teacher digital competence	0.408	<.001
Inclusive lesson design	0.350	<.001
Digital differentiation and assessment	0.410	<.001
Learner and family engagement	0.294	<.001
Leadership support	0.329	<.001

Variable	Spearman ρ	p
Professional learning support	0.328	<.001
Connectivity reliability	0.139	0.020
Device adequacy	0.071	0.240
Accessibility support	0.144	0.016

Two-tailed tests; n = 278. Correlations described association and did not establish causation.

Digital differentiation and assessment showed the strongest bivariate association with inclusive policy implementation ($\rho = .428$, $p < .001$), followed by teacher digital competence ($\rho = .415$, $p < .001$), inclusive lesson design ($\rho = .373$, $p < .001$), professional learning support ($\rho = .333$, $p < .001$), and leadership support ($\rho = .317$, $p < .001$). Learner and family engagement also had a meaningful positive association ($\rho = .286$, $p < .001$). Connectivity and device adequacy showed smaller correlations, indicating that infrastructure was relevant but less closely aligned with day-to-day implementation than pedagogical and organizational practices.

4.5 Cluster-Adjusted Predictors

Table 5. Generalized estimating equation estimates for inclusive policy implementation

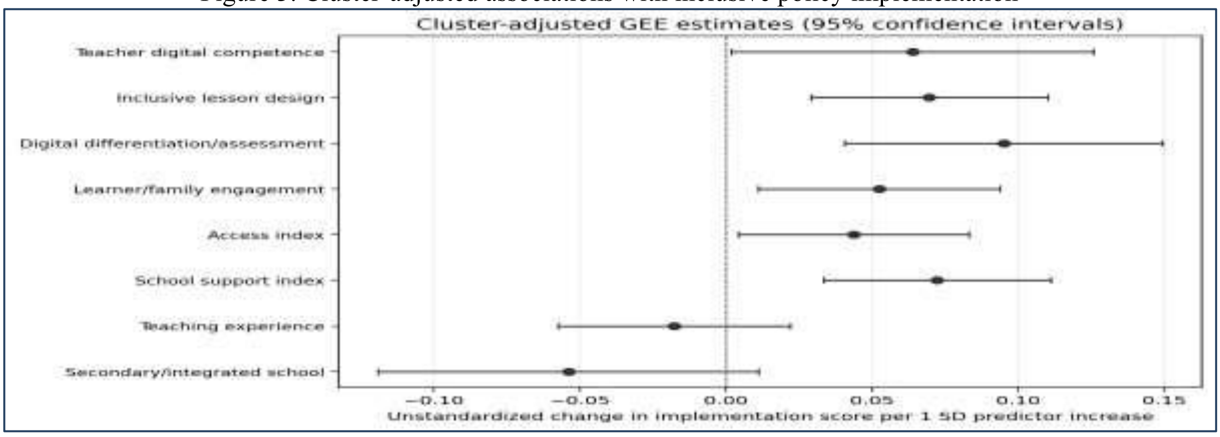
Predictor	B	Robust SE	95% CI	p
Intercept	3.954	0.025	[3.905, 4.003]	<.001
Teacher digital competence	0.064	0.032	[0.002, 0.126]	0.044
Inclusive digital lesson design	0.070	0.021	[0.029, 0.110]	<.001
Digital differentiation and assessment	0.095	0.028	[0.041, 0.149]	<.001
Learner and family engagement	0.052	0.021	[0.011, 0.094]	0.013
Access index	0.044	0.020	[0.004, 0.083]	0.030
School support index	0.072	0.020	[0.033, 0.111]	<.001
Teaching experience	-0.018	0.020	[-0.058, 0.022]	0.382
Secondary/integrated school	-0.054	0.033	[-0.119, 0.011]	0.104

Continuous predictors were standardized. The access index combined connectivity reliability and device adequacy. The school support index combined leadership, professional learning, and accessibility support. GEE used a Gaussian family, identity link, exchangeable working correlation, and robust standard errors clustered by school. Marginal pseudo-$R^2 = .315$.

After clustering and simultaneous adjustment, digital differentiation and assessment had the largest coefficient ($B = 0.095$, 95% CI [0.041, 0.149], $p < .001$). A one-standard-deviation increase in this domain was associated with a 0.095-point increase in the 1–5 implementation score. School support ($B = 0.072$, $p < .001$), inclusive digital lesson design ($B = 0.070$, $p = .001$), teacher digital competence ($B = 0.064$, $p = .044$), learner and family engagement ($B = 0.052$, $p = .013$), and the access index ($B = 0.044$, $p = .030$) also remained significant. Teaching experience and school level were not independently associated with implementation.

The model explained approximately 31.5% of outcome variance through population-averaged fitted values. The absence of an independent experience effect suggested that digital inclusion was not simply a function of years in service. Similarly, the nonsignificant school-level contrast indicated that the same implementation principles were relevant across elementary and secondary or integrated schools. The significant access coefficient confirmed that infrastructure still mattered, but its smaller magnitude showed that infrastructure generated inclusive value when it was converted into differentiated, accessible, and supported pedagogy.

Figure 3. Cluster-adjusted associations with inclusive policy implementation



Points represented GEE coefficients; horizontal lines represented 95% confidence intervals.

4.6 Integrated Case Themes

Table 6. Integrated case themes and supporting patterns

Theme	Integrated interpretation
1. Offline-first adaptation made participation possible	Teachers' stronger ratings for low-bandwidth versions and scaffolds indicated that digital pedagogy was often blended with print, downloaded files, shared-device routines, and asynchronous communication.
2. Pedagogical use exceeded infrastructure quality	Policy implementation remained high despite moderate connectivity and device adequacy, but access conditions retained a smaller independent effect.
3. Differentiated assessment was the central mechanism	Flexible tasks, multiple response formats, learner-data use, and feedback were most strongly associated with implementation.
4. School support converted individual skill into routine practice	Leadership, professional learning, and accessibility support jointly predicted implementation after individual competence was controlled.
5. Family communication and early identification required strengthening	Low-cost family engagement and early identification were among the weaker indicators, limiting continuity between home, classroom, and support services.
6. Monitoring needed to move from compliance to improvement	Evidence review and inclusion indicators needed stronger integration into school improvement cycles.

5. Discussion

5.1 Digital Pedagogy as an Implementation Mechanism

The findings indicated that digital pedagogy supported inclusive education most directly when it changed instructional design and assessment. Digital differentiation and assessment produced the strongest adjusted association with implementation. This result was consistent with UDL, which emphasized flexible means of representation and expression, and with DigCompEdu, which treated assessment and learner empowerment as central digital competences.[12,14] It also supported inclusive pedagogy's proposition that teachers should extend the range of ordinary classroom opportunities rather than reserve adaptation for a separate group.[16]

The practical implication was that school digital programs should be evaluated through learner access and participation rather than equipment counts. A device became an inclusive resource when it enabled alternative formats, timely feedback, scaffolding, flexible grouping, accessible communication, or a reasonable accommodation. A connectivity project became educationally meaningful when teachers could use it to obtain, adapt, and distribute resources in formats that learners could actually use. This interpretation followed UNESCO's warning that technology by itself did not guarantee quality or equity.[9]

5.2 Teacher Competence Was Necessary but Not Sufficient

Teacher digital competence was high and remained a significant predictor, but its coefficient was smaller than that of differentiation and assessment. This pattern suggested that operational skill and resource-selection knowledge were enabling capabilities rather than final outcomes. Teachers could be technically competent without consistently designing accessible materials or modifying assessment. The result aligned with TPACK, which located effective practice at the intersection of technological, pedagogical, and content knowledge.[13] It also reflected research showing that teacher knowledge, confidence, beliefs, and culture jointly influenced technology integration.[17]

Professional development should therefore move beyond tool demonstrations. Teachers needed guided practice in checking barriers, creating captioned or text-supported resources, designing low-bandwidth alternatives, selecting culturally responsive examples, protecting learner data, and using evidence from digital or blended assessment. The Philippine review of professional development supported sustained and context-aligned programs rather than isolated seminars.[26] A division coaching model could combine demonstration lessons, peer planning, classroom implementation, observation, and revision.

5.3 Rural Access Required a Redundant Delivery Architecture

Connectivity and device adequacy were the weakest domains, yet the access index remained independently associated with implementation. This finding prevented an overly optimistic conclusion that pedagogy could fully compensate for infrastructure. Teachers' adaptations reduced the effect of access barriers, but they could not eliminate them. Rural inclusion therefore required a redundant delivery architecture: online resources where feasible, downloadable and offline files, printed materials, audio or radio-compatible content, device-sharing plans, school access points, and accessible family communication.

Such redundancy was not a temporary emergency arrangement. It represented universal design for uncertain access conditions. Global evidence had shown that digital divides followed geography and socioeconomic status, while the Philippine pandemic experience revealed the combined effects of connectivity, devices, learning environments, and communication.[21,22] DepEd's distribution of e-learning devices to remote North Luzon schools and expansion of computerization addressed an important resource layer.[24,25] The present findings suggested that procurement should be paired with maintenance, accessibility specifications, offline content, and teacher coaching.

5.4 School Support and Sustainability

The school support index was a strong independent predictor. Leadership, professional learning, and accessibility support appeared to convert individual teacher skill into routine institutional practice. This result was consistent with the remote-rural Philippine case in which a community of practice, contextual integration, and adequate support sustained ICT use.[27] It also reflected international evidence that technology adoption depended on perceived usefulness and enabling conditions.[18]

Sustainability required roles, time, and evidence. School heads needed to protect collaborative planning time, designate technical and inclusive-education support, align resource requests with learner barriers, and monitor unresolved access problems. Division technical assistance needed to use school evidence rather than generic training calendars. Accessibility support could be organized through shared expertise, resource templates, and referral links when every school could not maintain a full specialist team.

5.5 Family Engagement, Identification, and Monitoring

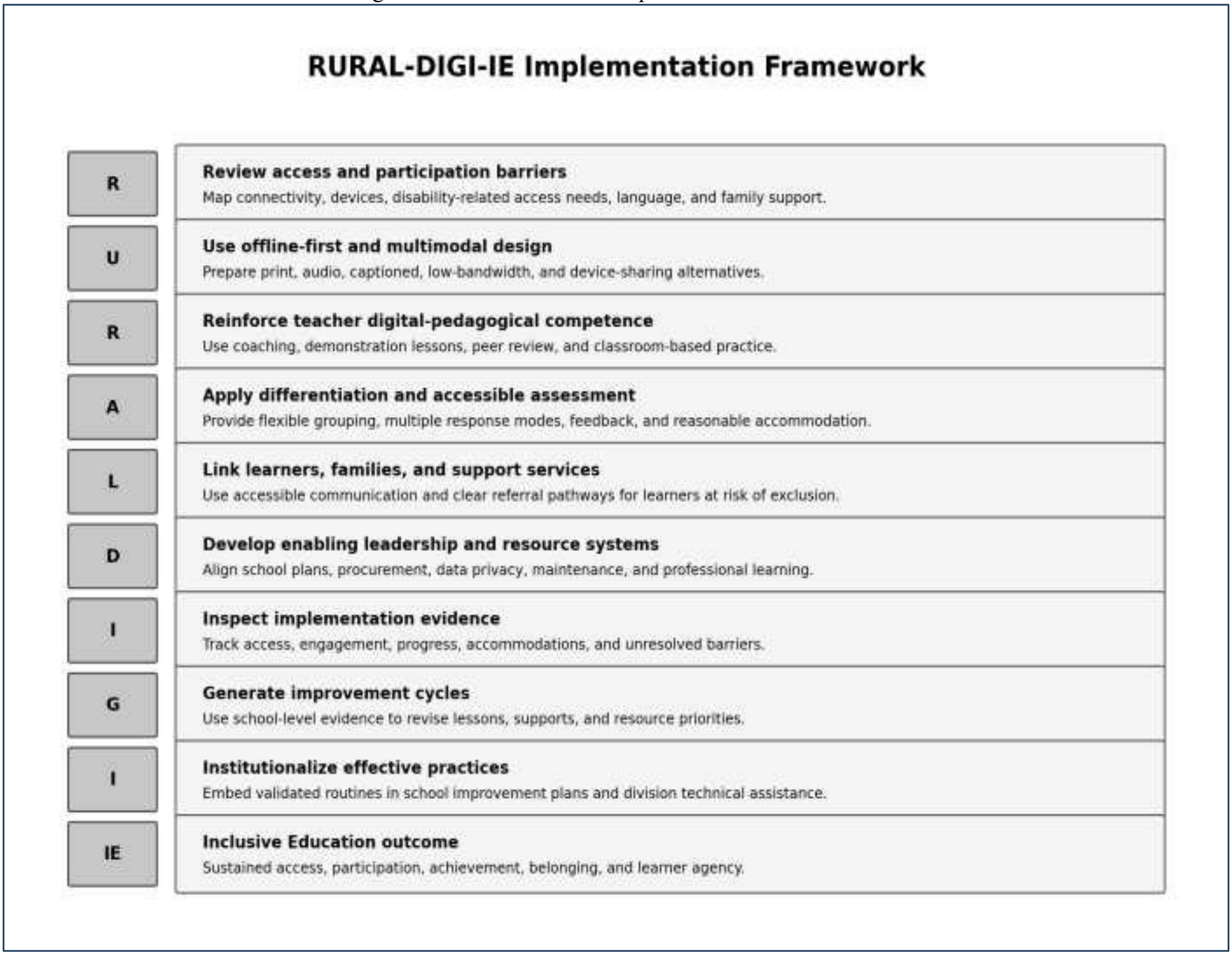
The weaker family communication and early-identification indicators exposed a policy implementation gap. Digital pedagogy could increase communication frequency, but families differed in devices, data, literacy, language, time, and confidence. Low-cost channels therefore needed clear schedules, accessible formats, consent and privacy procedures, and non-digital alternatives. Child-find and referral procedures also needed to connect with classroom evidence, including attendance, participation, task completion, and response to scaffolds.[4]

Monitoring should not become a new paperwork burden. A small set of inclusion indicators could be incorporated into existing school improvement and learning-monitoring processes: learners unable to access assigned formats, accommodations requested and provided, participation gaps, unresolved referrals, family contact completion, progress after intervention, and accessibility issues in frequently used resources. Evidence review was among the lower policy indicators, so a feedback cycle was needed to ensure that data changed practice.

5.6 The RURAL-DIGI-IE Framework

The integrated results produced the RURAL-DIGI-IE framework. The framework organized implementation as a continuous cycle rather than a linear technology rollout. It began with barrier review, required redundant and multimodal design, reinforced teacher competence through practice, applied differentiation and accessible assessment, linked families and services, developed leadership and resource systems, inspected evidence, generated improvement cycles, and institutionalized effective routines. The endpoint was inclusive education expressed through access, participation, achievement, belonging, and learner agency.

Figure 4. RURAL-DIGI-IE implementation framework



RURAL-DIGI-IE = Review, Use, Reinforce, Apply, Link, Develop, Inspect, Generate, Institutionalize, Inclusive Education.

6. Recommended Division and School Actions

Table 7. Proposed implementation actions

Priority	Core action	Suggested timing	Responsible units
Barrier and access mapping	Use a common school tool to identify connectivity, device, disability-related, language, and family-access barriers before selecting digital platforms.	Beginning of each school year; update quarterly	School heads, inclusive education coordinators, ICT coordinators
Accessible resource standards	Require readable layouts, captions or transcripts, alternative text where relevant, downloadable files, low-bandwidth versions, and print alternatives for core resources.	Phased within one year	Curriculum, learning resources, ICT, and inclusive education teams
Classroom coaching cycles	Organize peer planning, demonstration, implementation, observation, and revision focused on inclusive digital lessons and assessment.	At least one cycle per quarter	District supervisors, master teachers, school learning action cells
Flexible assessment protocols	Develop templates for multiple response formats, reasonable accommodations, data privacy, and feedback without reducing learning standards.	Within two quarters	Curriculum supervisors and assessment teams
Family communication architecture	Set accessible, low-cost, predictable channels with consent, privacy safeguards, and non-digital alternatives.	Immediate and continuous	Class advisers, guidance personnel, school heads
Evidence-driven monitoring	Track a small set of access, participation, accommodation, referral, and progress indicators and use them in school improvement reviews.	Quarterly	School governance and operations, planning, and school teams
Resource sustainability	Link procurement with maintenance, charging and storage, offline content, accessibility specifications, and teacher support.	Annual budgeting cycle	Division and local school boards

The actions were proposed for empirical validation and adaptation through consultation with the division, schools, teachers, learners, families, and local partners.

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