

Teaching at the Margins as Multigrade Pedagogy in Last Mile Schools

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ABSTRACT

This study explored how multigrade teachers enacted pedagogy in last-mile elementary schools in Baggao, Cagayan, with emphasis on differentiated instruction, learner participation, resource-adaptive teaching, and professional pedagogical capacity. A cross-sectional pedagogical mapping design was employed among 20 multigrade teachers selected through criterion-based total enumeration. Data were gathered using the validated Multigrade Pedagogy in Last-Mile Schools Scale and analyzed through a Bayesian cumulative-link multilevel model to preserve the ordinal structure of the responses. Results showed that learner participation demonstrated the strongest enactment, with a predicted high-enactment probability of .79, followed by differentiated instruction at .73 and professional pedagogical

capacity at .64. Resource-adaptive teaching obtained the lowest probability at .52 and produced a negative posterior estimate of -0.36, indicating persistent constraints in access to grade-appropriate materials, digital resources, and instructional support. Pairwise posterior contrasts further showed that learner participation and differentiated instruction were substantially stronger than resource-adaptive teaching. The findings suggest that multigrade teachers were able to sustain meaningful classroom engagement and instructional flexibility despite structural limitations. Strengthening multigrade-specific professional development, localized instructional resources, assessment support, and access to appropriate learning technologies is recommended to reduce dependence on individual teacher improvisation and support more sustainable pedagogy in last-mile schools.

Keywords: *differentiated instruction, last-mile schools, learner participation, multigrade pedagogy, professional capacity, resource adaptation*

INTRODUCTION

Providing elementary education in geographically isolated communities requires teaching arrangements that respond to conditions quite different from those of conventional schools. In the Philippines, many schools serving remote and underserved communities operate with limited classrooms, small enrolment, few teachers, and difficult physical access. These conditions are recognized under the Department of Education's Last Mile Schools Program, which identifies multigrade classes as one of the characteristics commonly found in schools facing persistent limitations in educational access and resources (Department of Education [DepEd], 2019).

Multigrade education allows one teacher to handle learners from two or more grade levels within the same classroom. While this arrangement makes elementary education possible in communities where separate teachers and classrooms for every grade may not be feasible, it also creates distinct pedagogical demands. A national review of the Multigrade Program in Philippine Education found that the program remains a practical means of extending basic education to isolated and sparsely populated communities, although concerns involving instructional quality,

teacher support, learning resources, and program implementation continue to affect its delivery (SEAMEO INNOTECH, 2020).

The work of a multigrade teacher therefore involves more than presenting lessons to several groups of learners. Teachers must organize different competencies, learning activities, assessment requirements, and classroom routines within a shared instructional period. Bongala et al. (2020) found that Philippine multigrade teachers employ differentiated activities, independent work, peer tutoring, and the teaching of common topics at varying levels of difficulty. At the same time, they encounter problems in lesson planning, instructional focus, learning materials, language use, and preparation for multigrade teaching.

Effective multigrade pedagogy also depends greatly on the teacher's capacity to make practical instructional decisions. Classroom management, collaborative learning, differentiated instruction, connections to real-life situations, technology use, and teacher flexibility have been identified as important strategies for sustaining learning across grade levels (Naparan & Alinsug, 2021). Yet such adaptability develops under demanding working conditions. Multigrade teachers have reported difficulties related to workload, insufficient resources, limited training, classroom management, travel to remote stations, and stakeholder support, showing that pedagogy in these schools is closely tied to the realities surrounding teachers' everyday work.

These realities make last-mile teaching an important area of educational inquiry. Studies of teachers in far-flung Philippine schools show that managing several grade levels requires resourcefulness, resilience, careful use of time, and instructional approaches responsive to learner differences (Rondero & Casupanan, 2024). However, much of the available literature discusses multigrade teaching through broad program assessments or studies conducted in other Philippine localities. Less attention has been given to how teachers themselves enact multigrade pedagogy within last-mile elementary schools in Baggao, Cagayan. Understanding their instructional practices, adaptations, challenges, and professional responses can provide a grounded account of what teaching at the margins actually demands. Thus, the study *Teaching at the Margins as Multigrade Pedagogy in Last Mile Schools* seeks to examine how multigrade teachers in last-mile elementary schools carry out teaching amid the instructional and structural conditions that shape their daily practice.

Literature Review

Differentiated Instruction in Multigrade Classrooms

Multigrade teaching requires instruction that recognizes differences in grade level, readiness, learning pace, and academic ability while keeping learners productively engaged within one classroom. Differentiated instruction offers a practical structure for addressing these differences because teachers can adjust tasks, learning materials, grouping arrangements, and expected outputs according to learner needs. Shareefa (2021) found that differentiated instruction in multigrade classes supported both academic progress and psychosocial development, although its effective use depended on teachers' competence, preparation time, and ability to assess learners across grade levels. This suggests that multigrade pedagogy is not simply the simultaneous delivery of separate grade-level lessons. It involves deliberate decisions about when learning may be shared across groups and when instruction must be adjusted to particular levels. For teachers in last-mile schools, such differentiation becomes central to maintaining meaningful learning despite differences in age, competency, and curricular expectations.

Learner Diversity and Inclusive Classroom Participation

The mixed composition of a multigrade classroom places learner diversity at the center of teaching practice. Differences in age, ability, prior learning, language, and independence require teachers to create opportunities in which learners can participate without being restricted by rigid grade-level boundaries. Taole (2020) emphasized that multigrade teachers need to design learning experiences responsive to individual differences while building an inclusive classroom environment where learners at various developmental levels can participate meaningfully. Such a setting can encourage cooperation, peer assistance, and shared learning, but these benefits depend on how teachers organize interaction and distribute instructional attention. In last-mile

elementary schools, inclusive multigrade pedagogy therefore rests on the teacher's capacity to recognize learner differences while keeping the classroom functioning as a connected learning community.

Resource Management and Instructional Adaptation

Teaching in multigrade schools is also shaped by how teachers use the resources available to them. Materials designed for conventional single-grade classes may not readily support simultaneous teaching across several grade levels, requiring teachers to select, reorganize, share, or modify resources according to immediate classroom needs. Msimanga (2019) observed that although resources in multigrade schools had improved, materials specifically developed for multigrade instruction remained inadequate, placing greater responsibility on teachers to manage existing resources creatively. Resource limitations can consequently influence lesson sequencing, independent activities, grouping strategies, and the amount of direct instruction that each grade receives. Within last-mile schools, instructional adaptation can therefore be understood as a practical dimension of pedagogy through which teachers make available materials workable for the learners and conditions they actually encounter.

Professional Capacity for Multigrade Pedagogy

The effectiveness of multigrade education depends considerably on whether teachers possess preparation specifically suited to teaching more than one grade at a time. Multigrade classrooms require competencies in curriculum integration, flexible grouping, independent learning, classroom organization, assessment, and adaptation to limited-resource environments. Ares-Ferreirós et al. (2025), in a systematic review of 40 international studies, identified teacher training and professional development as major concerns alongside instructional methods, organizational arrangements, educational opportunities, and school-community relationships in multigrade education. Their synthesis indicates that multigrade teaching should be treated as a distinct pedagogical field rather than as an improvised response to teacher shortages or small enrolment. This perspective is especially relevant to last-mile schools because the quality of teaching rests not only on teachers' willingness to adjust but also on whether they are professionally equipped to make sound pedagogical decisions under demanding conditions.

METHODS

Research Design

The study employed a cross-sectional pedagogical mapping design, operationalized through an analytic survey with ordinal-response modeling. Rather than treating multigrade teaching as a single general practice, the design mapped how teachers enacted pedagogy across differentiated instruction, learner participation, resource-adaptive teaching, and professional pedagogical capacity. The approach allowed patterns of teaching practice to be examined simultaneously while preserving the ordered nature of the teachers' responses. It was considered appropriate because the inquiry focused on how multigrade pedagogy was enacted under last-mile conditions rather than on respondents' personal characteristics.

Research Locale

The research was conducted in Baggao, Cagayan, among public elementary settings officially operating multigrade classes under geographically challenging educational conditions. The municipality falls under the Schools Division of Cagayan; who's current public-school directory identifies elementary education services across Baggao. Multigrade classes were treated according to the Department of Education Region II definition of classes in which one teacher assumed responsibility for learners belonging to two or more grade levels (Department of Education Region II, 2017). Only teaching assignments falling within the study's last-mile and multigrade criteria were covered.

Participants and Sampling Technique

The main study involved 20 multigrade elementary teachers from Baggao, Cagayan. Criterion-based total enumeration was applied to teachers appearing in the eligible study roster. Inclusion required current assignment in a DepEd-recognized last-mile elementary setting, direct responsibility for two or more grade levels within a multigrade class, and completion of one full school year of multigrade teaching experience. Teachers assigned exclusively to monograde classes and personnel without direct classroom teaching responsibilities were excluded. This procedure maintained a focused group whose actual instructional responsibilities corresponded closely with the phenomenon examined.

Research Instrument

Data were collected through the researcher-developed Multigrade Pedagogy in Last-Mile Schools Scale (MPLMSS). The instrument contained 32 statements distributed equally across four domains: differentiated instruction, learner participation, resource-adaptive teaching, and professional pedagogical capacity. Responses were recorded on a five-point scale ranging from 1, *Never*, to 5, *Consistently*.

Content validation was conducted by five specialists in elementary education, multigrade instruction, curriculum, educational measurement, and research methodology. Following the content validity procedure described by Yusoff (2019), the draft reporting analysis produced a scale-level content validity index of .94, with item-level indices ranging from .80 to 1.00. Suggestions concerning item clarity, overlapping statements, and terminology were incorporated before pilot administration.

The instrument was pilot-tested with 30 multigrade teachers outside Baggao who were not included in the main investigation. The draft reliability analysis yielded an overall Cronbach's alpha of .93. The coefficients were .86 for differentiated instruction, .88 for learner participation, .85 for resource-adaptive teaching, and .89 for professional pedagogical capacity. McDonald's omega was also estimated because it provides useful complementary evidence of internal consistency when scale items may not contribute equally to the construct (McNeish, 2018). The overall omega coefficient was .94. These coefficients indicated strong internal consistency of the proposed measurement structure.

Data Gathering

Approval to conduct the research was secured through the appropriate Schools Division and local education authorities. After authorization, the eligible teachers were contacted through the designated administrative channels and were given an explanation of the purpose, procedures, voluntary nature, and confidentiality provisions of the study. Written informed consent was obtained before questionnaire distribution. Printed copies were primarily used because differences in internet accessibility could have affected participation. Completed instruments were retrieved in sealed envelopes, assigned numerical codes, checked for completeness, and encoded without personally identifying information. Responses were then screened for missing or inconsistent entries before statistical analysis.

Data Analysis

The responses were analyzed using a Bayesian cumulative-link multilevel model, an approach appropriate for ordered response categories because it did not require Likert responses to be treated automatically as continuous measurements. Individual item responses were nested within teachers, while the four pedagogical domains were entered as the principal explanatory component. Posterior estimates were used to determine the relative strength with which each dimension of multigrade pedagogy was enacted. Results were expressed through posterior medians, estimated probabilities, and 95% credible intervals. Pairwise posterior contrasts were subsequently calculated to identify which pedagogical domains showed meaningfully stronger or weaker enactment. Model adequacy was examined through posterior predictive checks and convergence diagnostics. This treatment preserved the ordinal structure of the data and provided more informative uncertainty estimates than

conventional comparisons based solely on arithmetic means. Bayesian multilevel estimation followed the modeling principles described by Bürkner (2017).

Ethical Considerations

The study observed voluntary participation, informed consent, confidentiality, anonymity, and the right to withdraw without consequence. No teacher or school was identified in the dataset or manuscript. Responses were used exclusively for research purposes, stored securely, and reported only in aggregated form. Administrative permission did not replace individual consent, and participants were informed that their responses would have no bearing on employment evaluation or professional standing.

RESULTS AND DISCUSSION

Table 1. *Posterior Predicted Response Distribution Across Dimensions of Multigrade Pedagogy*

Dimension	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Consistently (%)	Probability of High Enactment, Often to Consistently
Differentiated Instruction	3	6	18	41	32	.73
Learner Participation	2	4	15	39	40	.79
Resource-Adaptive Teaching	7	13	28	34	18	.52
Professional Pedagogical Capacity	4	9	23	39	25	.64
Overall	4	8	21	38	29	.67

Table 1 presents the posterior predicted distribution of teachers' responses across the four dimensions of multigrade pedagogy. Learner participation showed the strongest pattern, with a .79 probability that practices were enacted often or consistently. Differentiated instruction followed at .73, indicating that teachers generally adjusted instruction across grade levels and learning needs. The overall probability of high enactment was .67, suggesting that multigrade pedagogy was generally sustained despite the demands of last-mile teaching.

A different pattern emerged for resource-adaptive teaching. Its probability of high enactment was only .52, while 28% of predicted responses fell under sometimes and another 20% under rarely or never. This result indicated that teachers were able to organize learning and maintain learner involvement more consistently than they were able to secure, modify, or maximize instructional resources. Professional pedagogical capacity also showed room for improvement, with a .64 probability of high enactment. The pattern suggested that effective classroom practice was present, but its sustainability remained affected by limitations in resources and specialized preparation.

Table 2. *Bayesian Posterior Estimates of Multigrade Pedagogy Dimensions*

Dimension	Posterior Median	95% Credible Interval	P(Effect > 0)	Predicted High-Enactment Probability	Rank
Learner Participation	0.67	[0.42, 0.92]	>.999	.79	1
Differentiated Instruction	0.48	[0.23, 0.73]	>.999	.73	2
Professional Pedagogical Capacity	0.19	[-0.04, 0.42]	.947	.64	3
Resource-Adaptive Teaching	-0.36	[-0.60, -0.12]	.002	.52	4

Table 2 shows the posterior estimates generated from the cumulative-link multilevel model. Learner participation obtained the largest positive posterior estimate at 0.67, with a 95% credible interval from 0.42 to 0.92. The probability that its effect exceeded zero was greater than .999. This provided strong evidence that practices involving learner involvement, peer support, independent activity, and shared classroom participation represented a prominent feature of multigrade teaching.

Differentiated instruction also demonstrated a clearly positive pattern, with a posterior median of 0.48 and a credible interval that remained above zero. Teachers therefore appeared capable of modifying learning activities and instructional demands for different grade levels within the same classroom. In contrast, professional pedagogical capacity produced a smaller posterior estimate of 0.19, and its credible interval extended slightly below zero. This indicated less certainty that specialized professional preparation was as firmly established as classroom-level instructional practice.

Resource-adaptive teaching produced the only negative posterior estimate, at -0.36, with the entire credible interval below zero. Its probability of having a positive effect was only .002. The result identified resource adaptation as the clearest weakness within the pedagogical structure. Although teachers appeared capable of compensating through flexible instruction, limitations in appropriate materials, technological access, and resources designed specifically for multigrade settings constrained the consistency of their practices.

Table 3. *Posterior Pairwise Contrasts Among Dimensions of Multigrade Pedagogy*

Comparison	Posterior Difference	95% Credible Interval	P(Difference > 0)	Interpretation
Learner Participation vs. Differentiated Instruction	0.19	[-0.02, 0.40]	.962	Learner participation tended to be stronger
Learner Participation vs. Professional Pedagogical Capacity	0.48	[0.24, 0.72]	>.999	Learner participation was stronger
Learner Participation vs. Resource-Adaptive Teaching	1.03	[0.76, 1.31]	>.999	Learner participation was substantially stronger
Differentiated Instruction vs. Professional Pedagogical Capacity	0.29	[0.06, 0.52]	.993	Differentiated instruction was stronger
Differentiated Instruction vs. Resource-Adaptive Teaching	0.84	[0.57, 1.12]	>.999	Differentiated instruction was substantially stronger
Professional Pedagogical Capacity vs. Resource-Adaptive Teaching	0.55	[0.31, 0.79]	>.999	Professional capacity was stronger

Table 3 presents the posterior contrasts among the four dimensions. The largest difference occurred between learner participation and resource-adaptive teaching, with a posterior difference of 1.03 and a probability greater than .999 that learner participation was stronger. Differentiated instruction also exceeded resource-adaptive teaching by 0.84. These differences showed that the principal weakness of multigrade pedagogy was not teachers' ability to engage learners or adapt instruction, but the material conditions supporting those practices.

Learner participation also exceeded professional pedagogical capacity by 0.48, while differentiated instruction was higher by 0.29. These results revealed an important pattern. Teachers appeared to have developed practical strategies for managing heterogeneous classrooms even when formal preparation and material support were less robust. The small difference between learner participation and differentiated instruction, whose credible interval crossed zero slightly, further suggested that these two practices operated at relatively comparable levels. Both emerged as the strongest components of teaching at the margins.

Table 4. *Lowest Posterior Predicted High-Enactment Probabilities Within Each Dimension*

Dimension	Instructional Indicator	Probability of Often or Consistently Practiced
Differentiated Instruction	Preparing separate assessment tasks for every grade level	.61
Differentiated Instruction	Adjusting activities immediately from formative evidence	.65
Learner Participation	Sustaining independent work while another grade received direct instruction	.70
Learner Participation	Organizing structured cross-grade peer assistance	.74
Resource-Adaptive Teaching	Accessing adequate grade-appropriate materials for simultaneous lessons	.44
Resource-Adaptive Teaching	Integrating digital resources despite connectivity limitations	.38
Professional Pedagogical Capacity	Receiving multigrade-specific professional development	.47
Professional Pedagogical Capacity	Using assessment approaches specifically designed for multigrade classes	.55

Table 4 identifies the areas that remained most difficult despite the generally favorable pattern of multigrade teaching. The weakest indicator involved the use of digital resources under connectivity constraints, with a predicted high-enactment probability of .38. Access to sufficient grade-appropriate materials was similarly limited at .44. These findings reinforced the domain-level result showing that resource-adaptive teaching represented the principal challenge.

Professional preparation also showed notable gaps. The probability that teachers regularly received multigrade-specific professional development was .47, while specialized multigrade assessment practices reached .55. These values suggested that much of the teachers' effectiveness may have developed through experience and practical adaptation rather than through sustained specialized training. Even within differentiated instruction, preparing separate assessment activities for every grade level remained challenging at .61, reflecting the workload created by simultaneous curricular expectations.

Taken together, the findings portrayed multigrade teachers as instructionally adaptive but structurally constrained. Their strongest practices centered on keeping learners involved and differentiating classroom experiences, while limitations became more visible when teaching depended on adequate resources, digital access, specialized assessment, and formal professional preparation. The results therefore suggested that strengthening multigrade education in last-mile schools should move beyond expecting teachers to compensate individually for difficult conditions. Greater attention was needed to resource provision, multigrade-specific professional learning, and assessment support so that effective teacher adaptation could be sustained rather than continually improvised.

CONCLUSION

Multigrade teachers in last-mile elementary schools demonstrated strong pedagogical capacity in sustaining learner participation and differentiating instruction across grade levels, indicating that effective multigrade teaching depended greatly on teachers' ability to organize learning flexibly and respond to varied learner needs. However, resource-adaptive teaching and specialized professional preparation remained weaker areas, particularly in the availability of grade-appropriate materials, digital access, multigrade-specific assessment, and sustained professional development. These patterns suggest that teachers were able to maintain instructional quality through practical adaptation, but their effectiveness was constrained by conditions beyond classroom-level decision making. It is therefore recommended that education authorities strengthen the provision of contextualized

multigrade learning materials, improve access to appropriate digital and non-digital resources, and establish sustained professional development focused specifically on multigrade planning, assessment, differentiation, and classroom organization. School-level support mechanisms should also provide teachers with greater opportunities for collaborative lesson preparation, sharing of localized instructional resources, and professional exchange so that successful practices may be sustained without placing excessive reliance on individual teacher adjustment.

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