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TEACHERS' ADOPTION OF MOODLE IN LOW-RESOURCE CONTEXTS: A MIXED-METHODS ANALYSIS OF PERCEIVED USEFULNESS, USABILITY, AND INSTITUTIONAL SUPPORT IN CAMEROON[i]

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Abstract:
Teacher professional development delivered through learning management systems (LMS) is often presented as a scalable pathway to strengthen teacher quality and system performance. Yet, in low-resource settings, adoption hinges on the interplay between individual perceptions (e.g., usefulness), platform design (e.g., usability under low bandwidth), and enabling conditions (e.g., institutional support). This article examines a national teacher onboarding programme in Cameroon that used Moodle as the core learning platform within a blended delivery model. Grounded in the Technology Acceptance Model (TAM) and sociotechnical theory, the study adopts a mixed-methods design that combines a large-scale survey (n = 1,522) and semi-structured interviews with beginner teachers (n = 15). Quantitative findings indicate that perceived usefulness is the strongest predictor of intention to use Moodle, while perceived ease of use and institutional support contribute additional explanatory power (R^2 = .244; F (3, 1518) = 164.289, p < .001). Group comparisons show a small but statistically significant gender difference in perceived ease of use, while area of residence (urban/rural) does not significantly differentiate intention to use. Qualitative findings reveal that recurrent electricity and connectivity constraints, platform workload (notably the portfolio), and delayed or absent support shape teachers' experience; however, teachers also

[i] ADOPTION DE MOODLE PAR LES ENSEIGNANTS DANS DES CONTEXTES À RESSOURCES LIMITÉES : ANALYSE MIXTE DE L'UTILITÉ, DE LA FACILITÉ D'UTILISATION ET DU SOUTIEN INSTITUTIONNEL PERÇUS AU CAMEROUN

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demonstrate adaptive strategies (e.g., phone-based learning, peer WhatsApp groups, and offline planning) that mitigate infrastructural fragility. Building on these findings and recent scholarship on digital learning in low-resource contexts, the article proposes a 'contextualised TAM' for teacher digital professional learning that explicitly incorporates infrastructural friction and adaptive capacity alongside classic TAM constructs.

Keywords: blended learning; novice teachers; technology adoption; Moodle; teacher professional development; low-resource contexts; institutional support

Résumé :
Le développement professionnel des enseignants dispensé par le biais de systèmes de gestion de l'apprentissage (LMS) est souvent présenté comme un moyen évolutif de renforcer la qualité des enseignants et les performances du système. Cependant, dans les environnements à faibles ressources, son adoption dépend de l'interaction entre les perceptions individuelles (par exemple, l'utilité), la conception de la plateforme (par exemple, la facilité d'utilisation avec une faible bande passante) et les conditions favorables (par exemple, le soutien institutionnel). Cet article examine un programme national d'intégration des enseignants au Cameroun qui a utilisé Moodle comme plateforme d'apprentissage principale dans le cadre d'un modèle de formation mixte. S'appuyant sur le modèle d'acceptation de la technologie (TAM) et la théorie sociotechnique, l'étude adopte une méthodologie mixte qui combine une enquête à grande échelle (n = 1 522) et des entretiens semi-structurés avec des enseignants débutants (n = 15). Les résultats quantitatifs indiquent que l'utilité perçue est le facteur le plus déterminant dans l'intention d'utiliser Moodle, tandis que la facilité d'utilisation perçue et le soutien institutionnel apportent une explication supplémentaire ($R^2 = 0,244$; $F (3, 1518) = 164,289$, $p < 0,001$). Les comparaisons entre les groupes montrent une différence de genre faible mais statistiquement significative dans la facilité d'utilisation perçue, tandis que la zone de résidence (urbaine/rurale) n'a pas d'incidence significative sur l'intention d'utilisation. Les résultats qualitatifs révèlent que les contraintes récurrentes en matière d'électricité et de connectivité, la charge de travail liée à la plateforme (notamment le portfolio) et le retard ou l'absence d'assistance influencent l'expérience des enseignants ; cependant, ces derniers font également preuve de stratégies d'adaptation (par exemple, apprentissage par téléphone, groupes WhatsApp entre pairs et planification hors ligne) qui atténuent la fragilité des infrastructures. S'appuyant sur ces résultats et sur des recherches récentes sur l'apprentissage numérique dans des contextes à faibles ressources, l'article propose un « TAM contextualisé » pour l'apprentissage professionnel numérique des enseignants qui intègre explicitement les frictions infrastructurelles et la capacité d'adaptation aux concepts classiques du TAM.

Mots clés : apprentissage mixte ; enseignants débutants ; adoption des technologies ; Moodle ; développement professionnel des enseignants ; contextes à faibles ressources ; soutien institutionnel

1. Introduction

The rapid mainstreaming of digital platforms for teaching, learning, and professional development has altered how education systems conceptualise scale, access, and instructional support. In many Sub-Saharan African countries, the growth of mobile connectivity, the diffusion of open-source learning management systems (LMS), and the policy push for digital transformation have jointly created new expectations: teacher learning should be continuous, data-informed, and increasingly supported by digital platforms rather than sporadic face-to-face workshops. At the same time, the "*promise of scale*" often collides with the realities of constrained infrastructure, intermittent electricity, costly or unstable internet, limited device ownership, and uneven digital competence, which can transform otherwise well-designed programmes into frustrating and inequitable experiences for teachers (Ahmed *et al.*, 2023; UNESCO, 2018; UNESCO, 2023).

Cameroon's Secondary Education and Skills Development Project (SESDP) exemplifies these tensions. The programme supported the onboarding of newly recruited secondary teachers through a blended learning professional development pathway in which Moodle served as the primary platform for structured learning activities, assessment tasks, communication, and evidence submission. The objective was not merely to "digitise" training delivery, but to establish a sustainable model of teacher professional learning that could be replicated, monitored, and improved over time. However, the adoption of such platforms cannot be taken for granted. As the study shows, a large proportion of beginner teachers struggled with technical barriers, workload features such as the portfolio, and inconsistent support; yet many also reported strong perceived value and willingness to recommend the programme to peers.

The study's significance is threefold.

First, it extends the empirical evidence based on teacher LMS adoption in African contexts by focusing on novice teachers during formal onboarding, an adoption moment where perceived benefits and usability are shaped simultaneously by institutional expectations and the teacher's early professional identity.

Second, it uses mixed methods to connect statistical patterns (predictors and group differences) with lived experience (barriers, workarounds, and perceived meaning).

Third, it provides a pragmatic agenda for "*implementation realism*": the design choices that make blended teacher development workable when bandwidth, power, and support are unreliable.

2. Literature Review and Theoretical Framing

2.1 Digital Teacher Professional Development and LMS-mediated Learning

Teacher professional development (TPD) has moved from discrete training events to continuous professional learning ecosystems that include coaching, communities of practice, micro-credentials, and platform-based content delivery. In this ecosystem, LMS

platforms are attractive because they can structure learning pathways, host resources, track participation, and support interaction at scale. For ministries and large projects, Moodle is a frequent choice because it is open source, configurable, and widely supported by a global community. However, successful platform-based TPD requires more than the availability of content: it demands alignment between pedagogy, assessment, facilitation, and the "conditions of use" experienced by teachers in their everyday contexts (Ahmed *et al.*, 2023; UNESCO, 2018).

Empirical studies in higher education and teacher education show that LMS adoption is shaped by perceived usefulness, perceived ease of use, self-efficacy, and service quality, with institutional readiness and training playing enabling roles (Mohamed Riyath & Muhammed Rijah, 2022; Mpungose, 2020; Sesmiarni *et al.*, 2024). In contexts where platform adoption is mandated, resistance may emerge when top-down introduction lacks a clear pedagogical rationale, adequate training, and supportive policy frameworks (Mpungose, 2020). These findings are especially relevant to teacher onboarding programmes, where participation is often compulsory, and completion has professional consequences. In such settings, adoption may reflect compliance rather than genuine acceptance and measured "use" may conceal dissatisfaction or disengagement.

2.2 Technology Acceptance Model: Strengths and Limitations in Low-Resource Settings

The Technology Acceptance Model (TAM) posits that perceived usefulness (PU) and perceived ease of use (PEOU) shape behavioural intention to use a technology, which in turn predicts actual use (Davis, 1989). TAM remains widely used in educational technology research because it is parsimonious, empirically tractable, and adaptable through extensions (Venkatesh & Bala, 2008). In teacher professional learning, PU is often interpreted as teachers' belief that the platform enhances their teaching capacity, professional progression, or instructional efficiency. PEOU reflects the perception that the platform can be used without excessive effort, confusion, or time costs.

Despite its utility, TAM can under-explain adoption in low-resource contexts because it tends to treat "external variables" as peripheral, when infrastructure and institutional conditions can dominate the user experience. For example, a teacher may strongly believe Moodle is useful for professional growth but still struggles to use it because of high data costs, power cuts, and device limitations. In such cases, PU remains high while PEOU is suppressed by contextual constraints; behavioural intention may remain positive, but actual use becomes inconsistent. Systematic reviews of eLearning adoption challenges highlight persistent barriers related to infrastructure, institutional readiness, digital competence, and technical support, precisely the factors that TAM often brackets as "external" (Ahmed *et al.*, 2023). Accordingly, many recent studies extend TAM with self-efficacy, service quality, facilitating conditions, and social influence to increase explanatory power and policy relevance (Mohamed Riyath & Muhammed Rijah, 2022; Sesmiarni *et al.*, 2024).

2.3 Sociotechnical Theory and "Infrastructural Friction"

Sociotechnical theory views technology implementation as the co-configuration of technical subsystems (tools, infrastructure, interface, workflows) and social subsystems (roles, norms, incentives, institutional culture, power relations). Adoption is therefore not merely a psychological judgement by individuals; it is an emergent outcome of how technology fits (or conflicts) with social practices and resource environments. Applied to teacher onboarding, a sociotechnical lens foregrounds questions such as: Who provides support and how quickly? How are tasks assessed and by whom? What professional risks do teachers perceive if they fail? What workarounds are socially acceptable? Which parts of Moodle reflect "institutional logics" rather than teacher realities?

In low-resource contexts, sociotechnical integration is strongly shaped by what can be termed infrastructural friction: the degree to which weak electricity, unstable connectivity, limited devices, and high data costs create extra effort that is not inherent to the platform's design. Infrastructural friction is not simply "lack of infrastructure"; it is the lived experience of repeated interruptions, delays, and constraints that increase cognitive load and time-on-task. It also shapes equity: teachers in rural areas, those with fewer financial resources, and those with lower digital literacy may experience higher friction, even when the platform is technically available.

2.4 Gender, Location, and Digital Inclusion

Digital inclusion research highlights that gender and location can influence digital access, confidence, and learning opportunities. In teacher development, gendered differences may arise from differential exposure to technology, workload distribution, or social expectations about competence. Location can also matter; rural areas often have poorer network coverage and less reliable electricity. However, recent work suggests that teachers in rural settings may develop adaptive strategies (e.g., collective phone sharing, offline planning, peer support) that partially offset resource disadvantages. Therefore, differences in adoption are not deterministic; they depend on programme design, support systems, and local coping strategies.

3. Conceptual Model and Hypotheses

Building on TAM and sociotechnical theory, the study examines how three determinants—perceived usefulness, perceived ease of use, and institutional support—predict novice teachers' intention to use Moodle in the onboarding programme. Institutional support is conceptualised as the availability, responsiveness, and helpfulness of training facilitators, technical helpdesks, and guidance mechanisms that reduce uncertainty and effort. Gender and area of residence are treated as grouping variables to explore whether adoption patterns vary across subgroups.

Hypothesis 1 (H1): Perceived usefulness positively predicts intention to use Moodle.
Hypothesis 2 (H2): Perceived ease of use positively predicts intention to use Moodle.
Hypothesis 3 (H3): Institutional support positively predicts intention to use Moodle.

Exploratory Question 1: Are there statistically significant differences in perceived ease of use and intention to use by gender?
Exploratory Question 2: Are there statistically significant differences in perceived ease of use and intention to use by area of residence (urban vs rural)?

To strengthen theory development, the discussion later introduces two contextual constructs:

a) infrastructural friction and
b) adaptive capacity, as mechanisms that help explain why PEOU and institutional support may exert different effects in low-resource settings, and why rural residence does not necessarily imply lower intention to use.

4. Methods

4.1 Research Design and Context

The study uses a convergent mixed-methods design. Quantitative data were collected through a structured survey administered to novice secondary teachers enrolled in the Moodle-based onboarding programme, while qualitative data were collected through semi-structured interviews with a sub-sample of participants. Mixed methods were selected to (a) estimate the magnitude of relationships among acceptance variables and (b) explain how contextual constraints and coping strategies shape the lived experience of adoption.

The training was delivered over 21 days and combined online Moodle activities with in-person sessions. Moodle hosted course resources, assignments, quizzes, discussion activities, and a portfolio that required evidence-based documentation of learning and practice. The programme aimed to build digital competence and pedagogical capacity while familiarising novice teachers with national expectations for professional practice.

4.2 Participants and Sampling

Survey invitations were distributed to 2,971 novice teachers enrolled in the programme. A total of 1,522 responses were obtained, yielding a 51% response rate. The sample comprised 56% female and 44% male respondents. Urban teachers represented 60% of the sample and rural teachers 40%. Respondents were distributed across several regions, with the Centre region comprising 38.5%, the Northwest 23.0%, the Littoral 22.6%, and the West 15.9%. The age distribution indicated a young cohort (mean age approximately 29.6 years), consistent with novice teacher status.

For qualitative inquiry, 15 participants were selected for semi-structured interviews. The sample included teachers from both urban and rural contexts and aimed to capture variation in platform experience. Interviews were conducted by phone or online, recorded, and transcribed to support thematic analysis.

4.3 Instruments and Measures

The survey instrument used a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Core constructs included perceived usefulness, perceived ease of use, institutional support, and intention to use. Additional items measured satisfaction and practical experience with course features and support services. The instrument also captured demographic variables (gender, region, area of residence) and background information (age, teaching experience).

Interview questions explored:

a) access to devices, electricity, and internet;
b) specific challenges encountered when using Moodle;
c) perceptions of the training's relevance and value;
d) experiences with institutional support; and
e) strategies used to cope with constraints.

Transcriptions were supported by digital transcription tools and then cleaned and validated by the research team prior to analysis.

4.4 Data Analysis

Quantitative analysis was conducted using SPSS. Because the dependent variable did not meet the normality assumption, Spearman's rho was used for correlation analysis. Multiple regression was used to estimate the predictive power of perceived usefulness, perceived ease of use, and institutional support on intention to use. Group differences were assessed using one-way ANOVA (gender) and Kruskal–Wallis tests (urban/rural) as appropriate.

Qualitative data were analysed using thematic analysis. The analysis followed established procedures: familiarisation with the data, initial coding, theme development, reviewing themes, defining and naming themes, and writing up findings (Braun & Clarke, 2006). To enhance trustworthiness, codes were discussed among the research team, and disconfirming evidence was actively sought.

4.5 Ethics

Participation was voluntary. Respondents provided informed consent, and confidentiality was maintained by removing identifying information from transcripts and reporting results in aggregate form. Given the professional consequences associated with teacher onboarding, emphasis was placed on ensuring that participation decisions did not affect training outcomes.

5. Results

5.1 Descriptive Findings: Access, Satisfaction, and Training Experience

The survey indicates strong endorsement of the programme's structure and perceived value. Approximately 88% of teachers reported that the course organisation supported their learning, and 94.6% stated that they would recommend the programme to

colleagues. At the same time, the results highlight significant constraints: 76% of respondents reported technical difficulties (particularly with login, navigation, and platform access), and institutional support was perceived as inconsistent 36% reported receiving no support and 47% perceived support as slow.

Perceived ease of use was mixed. About 61% reported that Moodle was easy to use, while 26% disagreed, suggesting a substantial subgroup that experienced usability barriers. Interview data contextualise these patterns: many teachers relied primarily on smartphones and mobile data, which constrained navigation and submission tasks, especially for portfolio-related work. Some teachers described connectivity and electricity challenges as chronic, requiring them to schedule learning activities around power availability or travel to areas with better coverage.

Table 1 summarises key descriptive characteristics of the survey sample.

Table 1: Descriptive Profile of Survey Respondents (n = 1,522)

Characteristic	Category / Statistic	n	%
Gender	Female	852	56.0
	Male	670	44.0
Area of residence	Urban	913	60.0
	Rural	609	40.0
Regional distribution	Centre	586	38.5
	Northwest	350	23.0
	Littoral	344	22.6
	West	242	15.9
Age	Mean (years)	29.6	—
Teaching experience	Mean (years)	2.6	—

5.2 Correlational analysis

Spearman correlations show statistically significant positive relationships among all acceptance variables. Intention to use is positively correlated with perceived usefulness (r = .434), perceived ease of use (r = .316), and institutional support (r = .259). Perceived usefulness is also correlated with perceived ease of use (r = .472) and institutional support (r = .306), while perceived ease of use correlates with institutional support (r = .301). These relationships suggest that teachers who perceive Moodle as valuable, easy to use, and supported by the institution are more likely to express intention to continue using it.

Table 2 presents the correlation matrix.

Table 2: Spearman Correlations among Acceptance Variables

Variable	IU	PU	PEOU	IS
1. Intention to Use (IU)				
2. Perceived Usefulness (PU)	.434			
3. Perceived Ease of Use (PEOU)	.316	.472		
4. Institutional Support (IS)	.259	.306	.301	

Note: Values are Spearman's rho (ϱ). All reported correlations were statistically significant.

5.3 Multiple Regression Predicting Intention to Use

A multiple regression model was estimated with intention to use as the dependent variable and perceived usefulness, perceived ease of use, and institutional support as predictors. The model is statistically significant and explains 24.4% of variance in intention to use ($R^2 = .244$; $F(3, 1518) = 164.289$, $p < .001$). All three predictors contribute positively and significantly.

Table 3: Multiple Regression Predicting Intention to Use (IU)

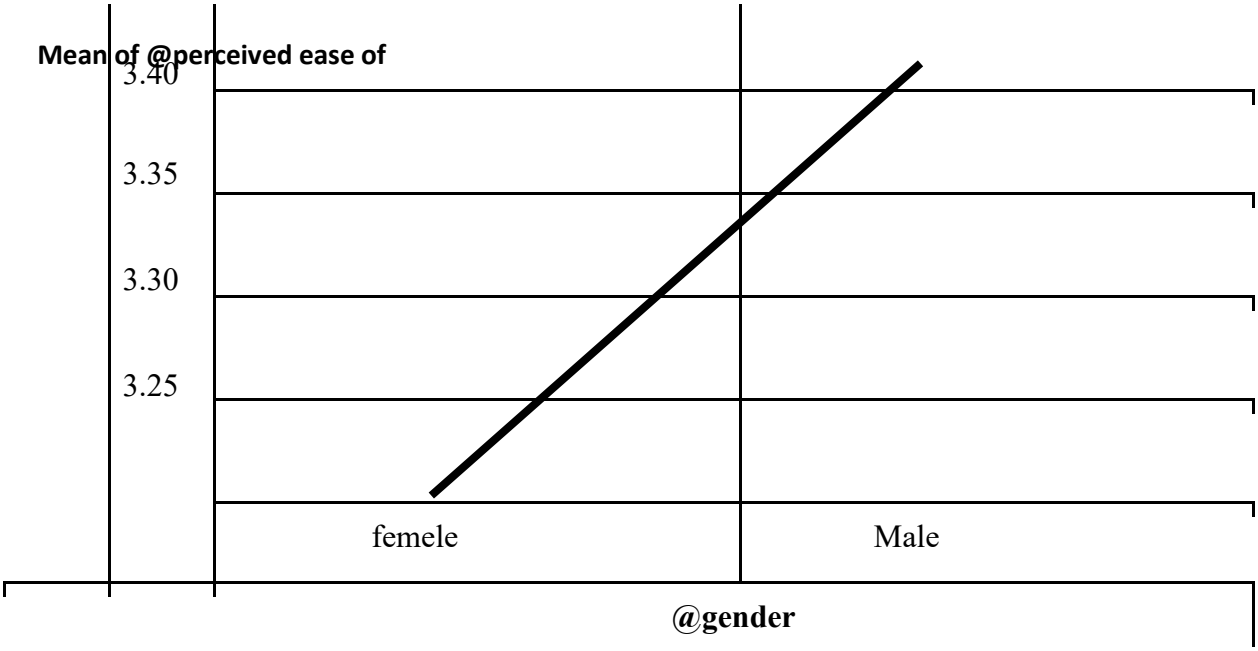
Predictor	B	SE	Beta	t	p
Perceived Usefulness	.341	.023	.341	14.573	<.001
Perceived Ease of Use	.120	.018	.138	6.763	<.001
Institutional Support	.119	.018	.118	6.676	<.001

Perceived usefulness emerges as the strongest predictor, indicating that teachers' belief in Moodle's value for professional learning is central to adoption. Nonetheless, usability and support remain important, suggesting that "value" alone cannot compensate for friction and lack of enabling conditions.

5.4 Group Differences by Gender and Area

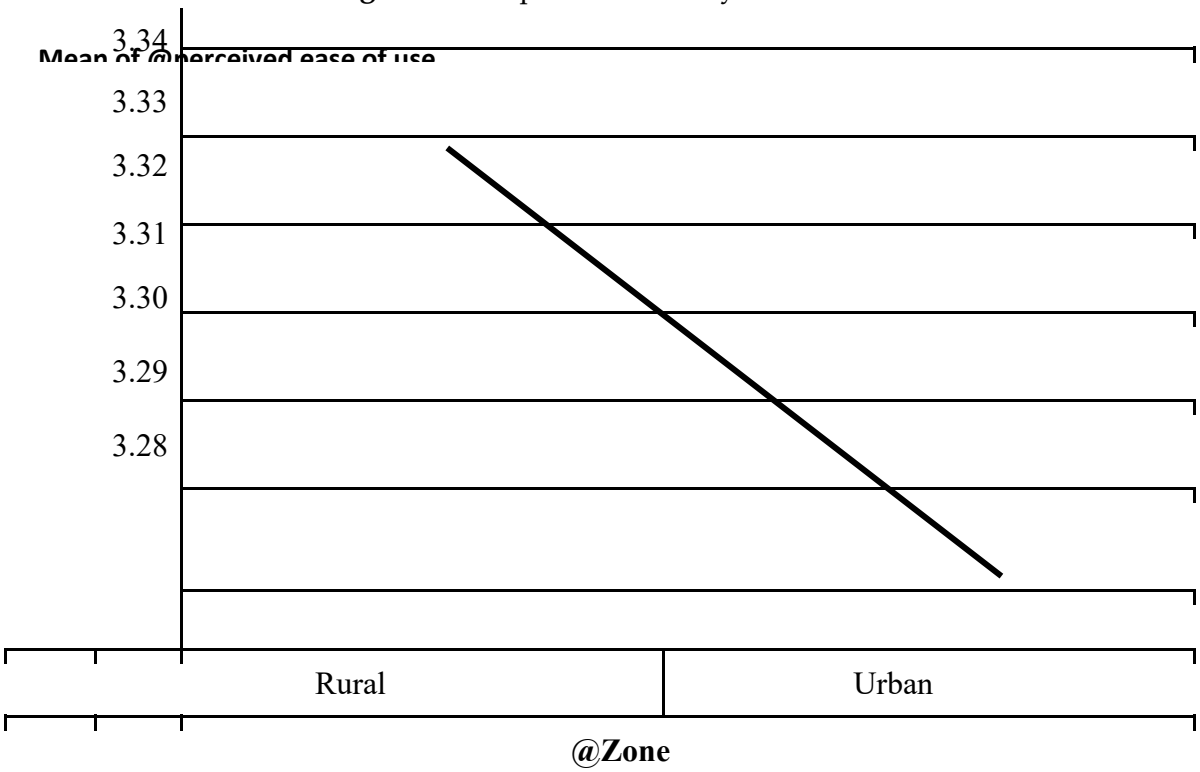
A one-way ANOVA indicates a statistically significant gender difference in perceived ease of use: male teachers report slightly higher ease of use ($M = 3.41$, $SD = .73$) compared to female teachers ($M = 3.24$, $SD = .72$), $F(1, 1520) = 19.209$, $p < .001$. However, perceived usefulness and institutional support do not significantly differ by gender in the reported analysis (Figure 3).

Figure 1: Comparison of FU by gender



Area of residence (urban vs rural) does not significantly differentiate perceived ease of use or intention to use. Kruskal–Wallis tests indicate no significant differences for perceived ease of use (H = .825, p = .364) and intention to use (H = .166, p = .684). This is an important result: despite the expectation that rural infrastructure constraints might reduce adoption, rural teachers report comparable intention to use, suggesting that adaptive strategies and perceived value may offset infrastructural disadvantages at the level of intention (Figure 2).

Figure 2: Comparison of FU by area



5.5 Qualitative Themes

Thematic analysis of interviews revealed five interrelated themes that deepen interpretation of the quantitative findings.

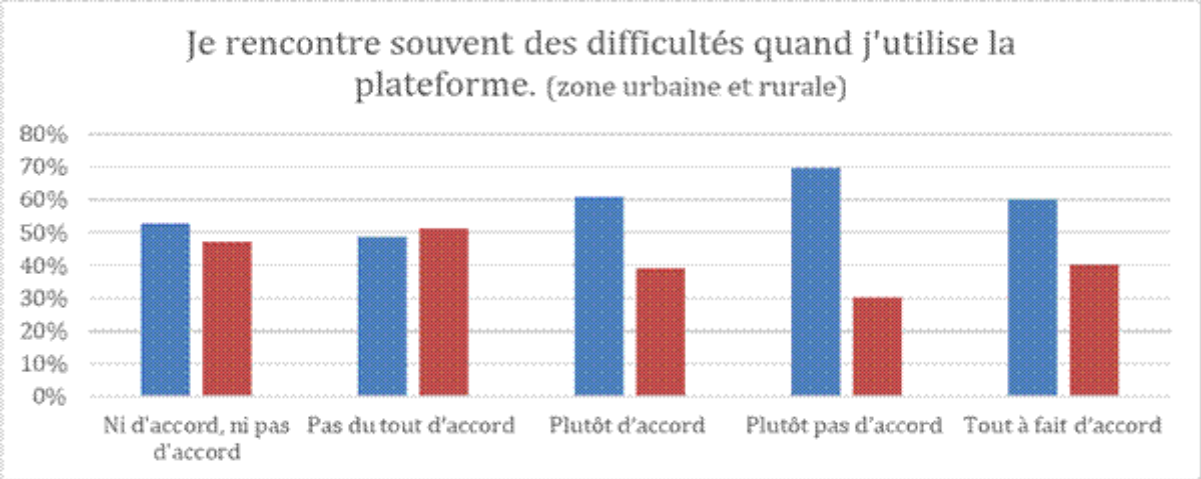
Theme 1: Infrastructural constraints and unequal access

Teachers repeatedly described electricity outages, unstable network coverage, and high data costs as primary obstacles. Many relied on smartphones (reported by participants as the dominant device), which limited the ease of typing, navigating, and uploading evidence. Some teachers travelled to urban centres or specific "network spots" to submit assignments, illustrating how infrastructural friction increases the hidden cost of participation.

Theme 2: Platform usability and workload concentration

While basic navigation was manageable for many, teachers reported difficulty with more complex features. The portfolio was frequently described as "heavy" and confusing, particularly when multiple documents had to be uploaded or formatted. Teachers perceived the portfolio as consuming time and data beyond what was reasonable for their working conditions (Figure 3).

Figure 3: Users' views on the difficulties encountered in using the platform



Theme 3: Institutional support and responsiveness

Teachers' experiences varied widely. Some reported helpful facilitators who provided timely explanations, while others described long delays or a complete absence of support. Several participants reported that they did not know where to seek help, suggesting gaps in communication and support workflows.

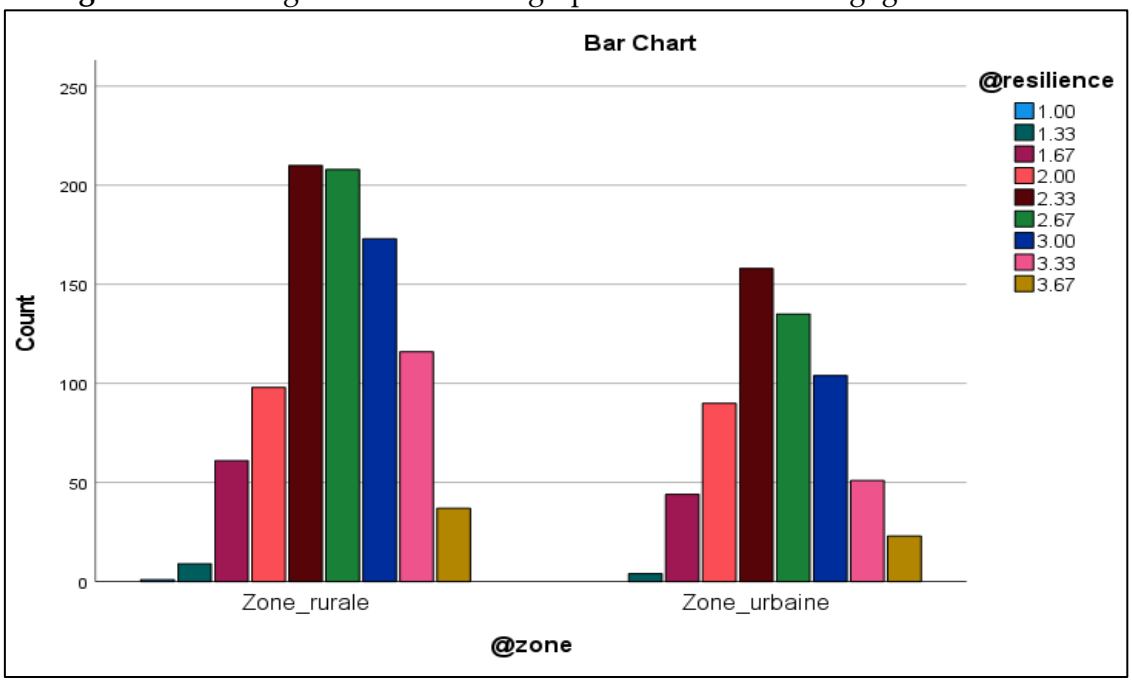
Theme 4: Perceived value, satisfaction, and professional identity

Despite constraints, many teachers emphasised the usefulness of the programme for improving classroom practice, understanding professional expectations, and building confidence as new teachers. Satisfaction was linked to perceived relevance and the sense of belonging to a professional community, especially when forums or peer groups enabled exchange.

Theme 5: Adaptive capacity and resilience strategies

Teachers developed coping strategies that reduced the impact of infrastructural friction: scheduling work around electricity, downloading materials for offline use, using WhatsApp groups for peer troubleshooting, and sharing devices or data bundles. These strategies help explain why rural teachers did not show lower intention to use: intention is not simply a function of infrastructure, but of how teachers and communities adapt to constraints (Figure 4).

Figure 4: Ki-2 Diagram between Geographical Area and Pedagogical Resilience



6. Discussion

6.1 Revisiting TAM in a Low-Resource Teacher Onboarding Context

The results broadly support classic TAM predictions: perceived usefulness and perceived ease of use are positively associated with intention to use Moodle, and usefulness is the strongest predictor. This is consistent with a large body of educational technology acceptance research showing that perceived value is often the dominant driver of intention, particularly when participation is tied to professional advancement (Davis, 1989; Venkatesh & Bala, 2008). The practical interpretation is straightforward: teachers are willing to invest effort into platform use when they believe the training improves their competence, increases their professional legitimacy, or supports their daily teaching.

However, the Cameroon case also underscores why TAM should not be applied in low-resource contexts without explicit attention to sociotechnical conditions. First, the variance explained ($R^2 = .244$) is meaningful but leaves substantial unexplained variance, implying the existence of additional determinants beyond PU and PEOU. Second, qualitative findings highlight that "ease of use" is shaped not only by interface design but by infrastructural friction (power, connectivity, device constraints) and programme workload design (portfolio complexity). Third, institutional support emerges as a statistically significant predictor, aligning with research that emphasises facilitating conditions and service quality as key to sustaining eLearning adoption (Ahmed *et al.*, 2023; Mohamed Riyath & Muhammed Rijah, 2022).

6.2 Institutional Support as a "Conversion Factor" from Intention to Sustained Use

In low-resource settings, institutional support acts as a conversion factor: it translates perceived value into actual participation by reducing friction, preventing dropout, and supporting successful task completion. The finding that 36% reported receiving no support and 47% reported slow support indicates that the support system was not experienced as reliably available. From an implementation perspective, this is a critical bottleneck. If teachers believe the platform is useful but repeatedly face unsolved access problems, the programme risks creating "surface compliance" (logins and submissions) while undermining long-term acceptance and trust.

The literature offers convergent lessons. Studies of Moodle uptake in universities have shown that when implementation is imposed without coherent training and support, resistance and workaround practices emerge, limiting educational potential (Mpungose, 2020). Conversely, research on LMS adoption among educators highlights that training to improve self-efficacy and service quality strengthens attitudes and intention (Mohamed Riyath & Muhammed Rijah, 2022). For teacher onboarding, support should therefore be designed as a service system, not an afterthought: clear escalation pathways, quick-turnaround troubleshooting, and peer-supported structures that reach teachers outside urban centres.

6.3 Gender Differences in Perceived Ease of Use: Interpreting a Small but Meaningful Gap

The finding that male teachers reported slightly higher perceived ease of use than female teachers is consistent with broader digital inclusion research indicating that gendered patterns of technology exposure and confidence can shape usability perceptions. Importantly, this difference is not evidence of inherent capability differences; rather, it points to differential opportunities for practice, prior exposure, and social expectations. In professional learning contexts, such differences can compound: teachers who feel less confident may avoid experimenting with platform features, increasing reliance on others and reinforcing the perception that tasks are difficult. Therefore, inclusive onboarding should incorporate gender-sensitive support measures, including structured hands-on practice, low-stakes experimentation, and mentoring that explicitly builds confidence for complex tasks (UNESCO, 2018).

6.4 Why Rural Teachers Did Not Report Lower Intention to Use: The Role of Adaptive Capacity

The absence of significant urban–rural differences in perceived ease of use and intention to use is a notable finding. Conventional assumptions would predict lower rural adoption due to weaker infrastructure. Interview evidence suggests that rural teachers often develop adaptive strategies—planning around electricity, travelling to network access points, relying on peer WhatsApp groups enable them to maintain intention and participation despite constraints. This aligns with sociotechnical perspectives that view technology use as a socially organised practice rather than purely individual choice. In

effect, rural teachers may compensate for infrastructural deficits through collective action and improvisation.

For programme design, this result has two implications. First, it is insufficient to evaluate equity solely through "intention" measures; actual usage data (logins, completion, time-on-task) may still show rural disadvantage if friction creates missed deadlines or incomplete submissions. Second, adaptive capacity can be intentionally supported: programmes can provide offline-capable materials, flexible submission windows, and peer-support structures to strengthen the coping strategies teachers are already using.

6.5 Toward Theory Development: A Contextualised TAM for Low-Resource Teacher Professional Learning

To strengthen the theoretical contribution, this article proposes a contextualised TAM for low-resource teacher digital professional learning. The extension does not discard TAM; it reframes what "ease of use" and "support" mean under infrastructural fragility and adds two contextual constructs that help explain adoption dynamics:

- **Infrastructural friction:** repeated interruptions and constraints arising from electricity instability, network unreliability, data costs, and device limitations. Infrastructural friction directly reduces perceived ease of use and indirectly reduces the realised benefits of the platform by increasing time and stress.
- **Adaptive capacity:** the individual and collective ability to develop coping strategies (e.g., offline planning, peer troubleshooting, device sharing) that reduce the negative effects of friction. Adaptive capacity can moderate the relationship between infrastructural friction and intention to use, and may be influenced by peer networks and institutional design choices.

This framework aligns with wider scholarship calling for adoption models that incorporate context, equity, and sustainability rather than assuming stable infrastructure and uniform user conditions (Ahmed *et al.*, 2023; UNESCO, 2023). It also suggests new hypotheses for future research, such as: adaptive capacity moderates the effect of infrastructural friction on perceived ease of use; and peer-supported communities enhance institutional support perceptions.

7. Practical Implications and Recommendations

This section translates the findings into implementable recommendations, organised by stakeholder group.

7.1 For Ministries and Programme Owners

1) Define minimum enabling conditions and budget for them. Large-scale teacher digital learning should include dedicated financing lines for connectivity subsidies, regional support hubs, and device access solutions (e.g., school-based

computer corners). Without these, programmes risk shifting costs onto teachers, undermining equity and motivation.

2) Build support systems into programme architecture. Establish a tiered support model: (a) local school-based focal points, (b) regional helpdesks with defined response times, and (c) central technical teams for platform issues. Service-level expectations should be explicit.
3) Align platform use with professional incentives. When teachers perceive direct professional benefits (certification, recognition, promotion pathways), perceived usefulness increases, and sustained engagement is more likely.

7.2 For Training Designers and Implementers

1) Redesign "high-friction" tasks for mobile-first learning. If most teachers use smartphones, portfolio tasks must be simplified: fewer uploads, template-driven responses, and staged submission with feedback. Consider converting parts of the portfolio into structured Moodle forms or quizzes.
2) Provide offline-first learning options. Make materials downloadable in low-size formats, provide printable summaries, and allow flexible submission windows for teachers affected by power cuts.
3) Use scaffolded onboarding and practice. Early modules should focus on "learning the platform" with low-stakes tasks that build confidence. Complex tasks (portfolio, multimedia uploads) should appear later with guided practice.
4) Integrate social learning intentionally. Peer WhatsApp groups emerged as a powerful coping mechanism. Rather than leaving them informal, implementers can create moderated peer groups linked to Moodle forums, with clear norms and support roles.

7.3 For School Leaders and Local Supervisors

1) Create protected time and access points. Scheduling protected time for teacher online learning and providing access to school devices (where available) can reduce friction.
2) Recognise and reward peer support. Teachers who provide informal troubleshooting can be recognised as "digital champions," strengthening community capacity.
3) Monitor participation with an equity lens. Leaders should track who is struggling (often those with higher friction) and intervene early with support rather than punitive measures.

7.4 For Platform Administrators and Developers

1) Prioritise usability under constraints. Optimise Moodle for low bandwidth (theme optimisation, compressed media, minimal heavy plugins) and ensure mobile-friendly navigation for key workflows.

2) Reduce cognitive load. Provide in-platform guidance, short video or image-based tutorials, and clear "where to click next" pathways for tasks.
3) Use analytics to identify friction points. Identify modules with high dropout or repeated failed submissions and redesign them iteratively.

8. Conclusion

This article demonstrates that novice teachers' adoption of Moodle for professional onboarding in Cameroon is shaped by both classic acceptance beliefs and the sociotechnical realities of low-resource environments. Perceived usefulness is the strongest driver of intention to use, but ease of use and institutional support remain critical, particularly when infrastructural friction is high. Qualitative evidence reveals substantial structural constraints alongside strong teacher agency and resilience strategies that sustain engagement. The findings support an extension of TAM that foregrounds infrastructural friction and adaptive capacity as context-specific determinants of platform-mediated teacher professional learning. For policy and practice, the central message is clear: successful adoption in low-resource contexts requires designing not only for learning content, but for the conditions of use, connectivity, support, responsiveness, mobile-first workflows, and equitable enabling environments.

Conflict of Interest Statement
The author(s) declare(s) that there is no conflict of interest regarding the publication of this article.

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