JUSTEK : JURNAL SAINS DAN TEKNOLOGI
http://journal.ummat.ac.id/index.php/justek
ISSN 2620-5475
Vol. 9, No. 3, September 2026, pp. 237-247

Smartphones in the Classroom: A Cross-Sectional Survey of Pre-Service Teachers' Academic Use, Perceived Benefits, and Challenges

Dedi Irwan
Program Studi Pendidikan Bahasa Inggris, FBSK, Univeristas PGRI Pontianak
dediirwanphd@gmail.com

ARTICLE INFO

Article History:

Received : 31-12-2026
Revised : 03-09-2026
Accepted : 05-09-2026
Online : 12-09-2026

Keywords:
Smartphone;
Pre-service Teachers;
Mobile Learning;
Survey Research.

ABSTRACT

Smartphones are the most widely available digital device in Indonesian teacher education, yet evidence on how pre-service teachers actually use them during formal instruction, and with what consequences, remains limited. This study examined the frequency of academic smartphone use during lectures, the learning benefits pre-service teachers perceive from such use, disciplinary variation in use patterns, and the challenges and support needs that accompany it. A descriptive–associative, cross-sectional survey was administered to 260 pre-service teachers enrolled in eight teacher education programmes at Universitas PGRI Pontianak, Indonesia. Data were analysed using descriptive statistics and chi-square tests of independence, with Cramér's V reported as a measure of effect size. Smartphone use during lectures was highly prevalent: 79.1% of respondents reported frequent to very frequent academic use, mainly to access learning materials and complete assignments. Use frequency was significantly associated with perceived learning benefit, $\chi^2(16) = 45.38$, $p < .001$, $V = .21$, whereas the association between disciplinary cluster and use frequency was weaker and lay at the conventional threshold, $\chi^2(12) = 21.02$, $p = .050$, $V = .16$. Limited internet data (55%) and distraction from non-academic applications (42%) were the most frequently reported constraints, and respondents were almost evenly divided over whether they needed institutional guidance. The findings position smartphones as a learning infrastructure that simultaneously affords access and imposes attentional costs, and they support guided, discipline-sensitive and infrastructure-aware integration in teacher preparation rather than blanket permission or prohibition.

A. INTRODUCTION

Smartphones have become an integral part of contemporary life, reshaping how people communicate, access information and engage in learning. The rapid diffusion of mobile technologies has made the smartphone the most ubiquitous digital device in higher education, allowing learners to reach educational resources, contact peers and instructors, and manage academic tasks with considerable flexibility (We Are Social, 2021; Crompton & Burke, 2018). In educational settings the device is therefore no longer only a communication tool but a portable learning infrastructure supporting both formal and informal learning (Peng et al., 2019).

In teacher education the role of smartphones is particularly consequential. Pre-service teachers are expected to use technology effectively for their own learning and, at the same time, to develop professional competence in digital pedagogy and classroom technology integration. Empirical evidence indicates that they routinely use smartphones to search

for academic material, access learning management systems, communicate with peers and organise study activities (İslamoğlu et al., 2021; Falade et al., 2021; Tong et al., 2023). Because technology use also shapes professional self-perception and job-related attitudes (Bülbül & Özelçi, 2025), smartphone use during initial teacher preparation functions as an implicit component of professional socialisation, influencing beliefs about effective teaching, technology use and classroom management.

Despite these affordances, prior studies consistently report that smartphone use in educational settings carries significant costs. Students often regard smartphones as useful learning tools while simultaneously reporting distraction, multitasking and non-academic use (Masadeh, 2021; Abidin, 2023). Indonesian studies describe the same duality: undergraduates value the immediacy of access that smartphones provide for coursework, yet also associate their use with reduced concentration and weaker academic performance (Murni et al., 2023; Nurhalifah et al., 2024). Research on prospective teachers likewise highlights the tension between academic affordance and disruption, and calls for clear guidelines and structured integration strategies (Chindia & Wawire, 2024; Galway et al., 2020). The educational value of the device therefore appears highly contingent on how its use is organised and regulated.

Contextual and structural conditions shape these outcomes further. Reliable connectivity, the affordability of data, and students' digital literacy have all been identified as determinants of effective mobile learning (Hennessy et al., 2022; Sophonhiranrak, 2021). Where infrastructure and access are uneven, the potential benefits of smartphone use are constrained and existing disparities in learning experience are reinforced. This is especially relevant for teacher education institutions in low- and middle-income settings, and in Indonesian provinces outside Java in particular, where mobile devices are near-universal but network coverage, data costs and institutional support vary sharply between urban centres and surrounding districts.

Pedagogical and motivational factors matter as well. Studies of mobile learning motivation among pre-service teachers indicate that motivation mediates the relationship between digital literacy and the development of teacher identity (Bülbül & Özelçi, 2025), while research on technology and pedagogy integration shows that students respond more positively when device use is tied to a clear instructional purpose (Nisa et al., 2023). Smartphone use alone therefore guarantees nothing; its effect depends on pedagogical alignment, self-regulation and institutional support.

Although the literature documents both the opportunities and the risks of smartphone use, three gaps remain. First, most studies address general student populations, and comparatively few examine pre-service teachers across several disciplinary contexts within a single institution. Second, benefits and drawbacks are usually reported in isolation, so there is limited evidence on whether the frequency of academic use is associated with the benefit students perceive. Third, little attention has been paid to how perceived benefits, reported challenges and the need for guidance coexist within the same population, particularly in teacher education, where these patterns carry professional consequences.

To address these gaps, this study adopts a descriptive–associative, cross-sectional survey design with four objectives: to describe how frequently and for which functions pre-service teachers use smartphones during lectures; to describe the learning benefits they perceive; to test whether use frequency and disciplinary cluster are associated with perceived benefit; and to identify the challenges and forms of support they report needing. The study is accordingly guided by four questions. (1) How frequently, and for what academic purposes, do pre-service teachers use smartphones during lectures? (2)

What learning benefits do they perceive from that use? (3) Is use frequency associated with perceived benefit, and does the pattern of use vary by disciplinary cluster? (4) What challenges and support needs do they report?

In answering these questions the study contributes to the mobile learning literature in three ways that correspond directly to the gaps set out above. First, by sampling pre-service teachers from eight programmes within one institution, it shows that the intensity of smartphone use is patterned by disciplinary demand while attention-related difficulty is not, which qualifies conclusions drawn from undifferentiated student samples. Second, by testing the association between use frequency and perceived benefit rather than reporting affordances and drawbacks separately, it provides evidence that the two are properties of the same device ecology rather than competing accounts of it. Third, by examining benefits, challenges and the need for guidance together, it identifies data affordability and uneven digital self-regulation as the practical conditions under which mobile learning either supports or erodes teacher preparation in a resource-constrained regional setting. Taken together, these findings give teacher education institutions in comparable contexts an empirical basis for designing guided integration rather than blanket permission or prohibition.

B. RESEARCH METHODOLOGY

This study employed a quantitative survey design with a descriptive–associative, cross-sectional orientation. Survey research is appropriate for describing the distribution of behaviours, perceptions and conditions within a defined population using standardised instruments (Groves et al., 2009; de Vaus, 2014), and a cross-sectional design was selected because all variables were measured once, without manipulation or intervention, which permits patterns and associations to be estimated in a natural setting (Setia, 2016). The descriptive–associative orientation reflects the dual aim of the study: to describe smartphone use patterns and perceived learning benefits, and to test non-causal associations among categorical variables (Creswell, 2014; Field, 2018). Because the objective was to establish how widely these patterns hold across a broad sample rather than to reconstruct individual experience, the design privileges breadth over depth; the implications of that trade-off are addressed in the limitations.

The study was conducted at Universitas PGRI Pontianak, a teacher education institution in West Kalimantan, Indonesia. Participants were 260 undergraduate pre-service teachers recruited from eight programmes: Mathematics Education, Indonesian Language Education, English Education, Physical Education, History Education, Pancasila and Citizenship Education, Information Technology Education, and Geography Education. For analysis these programmes were grouped into four disciplinary clusters, namely English Education, Information Technology Education, Physical Education and other teacher education programmes, so that variation in use patterns across disciplinary demands could be examined while retaining adequate cell frequencies for chi-square testing. Participation was voluntary and no incentive was offered, so the sample is best understood as a self-selected cross-section of the student population rather than a random sample.

Data were collected through a structured, self-administered online questionnaire developed for this study and aligned with the four research questions. The instrument measured five domains: the frequency of smartphone use during lectures, the functions and applications used for learning, the perceived learning benefits of that use, technical and non-technical challenges including data limitations and distraction from non-academic applications, and the perceived need for institutional guidance. Items used

Likert-type and categorical response options so that perceptions and behaviours could be compared in a standardised way, consistent with established survey practice in educational research (Dillman et al., 2014; Kelley et al., 2003). Content validity was established through expert review by lecturers in educational technology and research methodology, and the instrument was piloted before distribution. Item wording was kept short and concrete, and the sequence moved from behaviour to perception in order to reduce priming.

The questionnaire was distributed online to eligible students during the regular teaching semester. Participation was voluntary and anonymous, and respondents were free to withdraw before submission. Standard survey design principles were applied to limit measurement error, including clear item wording, logical sequencing and consistent response scales (Dillman et al., 2014; Groves et al., 2009).

Analysis proceeded in two stages that mirror the descriptive and associative aims. Descriptive statistics, reported as frequencies and percentages, summarised use patterns, perceived benefits and reported challenges. Chi-square tests of independence then examined the association between smartphone use frequency and perceived learning benefit, and between disciplinary cluster and use frequency. Chi-square testing is appropriate for categorical variables in non-experimental survey designs and supports relational rather than causal interpretation (Field, 2018). Expected cell frequencies were inspected before testing, and Cramér's V is reported alongside each test so that the strength of association, and not only its statistical significance, can be judged.

Ethical standards were maintained throughout. Participants gave informed consent before responding, anonymity and confidentiality were preserved, no identifying information was collected, and the data were stored securely and used solely for research purposes.

C. RESULT AND DISCUSSION

1. Research Result

Demographic Profile of Pre-Service Teacher Participants

The study involved 260 pre-service teachers enrolled in undergraduate teacher education programmes across several disciplines. Grouped by cluster, participants came from Physical Education programmes (33.1%, n = 86), English Education (31.5%, n = 82), other teacher education programmes such as social studies and languages other than English (26.2%, n = 68), and Information Technology Education (9.2%, n = 24). The findings therefore reflect technology use among pre-service teachers across diverse disciplinary contexts rather than within a single specialisation.

Frequency of Smartphone Use in Pre-Service Teacher Education

Overall, smartphone use during lectures was highly prevalent among pre-service teachers. Across the full sample, 79.1% of participants reported frequent to very frequent smartphone use to support learning activities, 18.9% reported occasional use, and only 1.9% reported rare or no use. This pattern suggests that smartphones have become an integral component of pre-service teachers' academic routines.

Examined by discipline, frequent use was dominant in every cluster but varied in intensity. Among English Education students, 76.8% reported frequent to very frequent use during lectures (29.3% very frequent, 47.6% frequent), 23.2% reported occasional use and none reported rare or no use. Information Technology Education students showed a similar profile, with 66.7% reporting frequent to very frequent use (20.8% very frequent, 45.8% frequent) and 29.2% occasional use.

Physical Education students displayed a comparatively lower concentration of intensive use. Although the majority still reported frequent to very frequent use (75.3%), a higher proportion reported occasional (22.4%) and rare (2.4%) use than peers in language- and technology-oriented programmes. A chi-square test confirmed that the association between disciplinary cluster and use frequency lay at the conventional threshold of significance, $\chi^2(12) = 21.02$, $p = .050$, Cramér's $V = .16$, indicating a weak relationship. Disciplinary context therefore appears to shape how intensively pre-service teachers rely on smartphones, but it accounts for only a small share of the variation and the result should be read as suggestive rather than conclusive.

Perceived Learning Benefits Across Pre-Service Teacher Disciplines

In terms of perceived learning benefit, 38.3% of pre-service teachers indicated that smartphones frequently or very frequently supported their learning, 45.8% reported moderate benefit and 15.9% reported low or no benefit. Students in language- and technology-oriented programmes were more likely to perceive frequent benefit than those in practice-oriented programmes such as Physical Education. Positive perceptions were nevertheless evident in every cluster, indicating that smartphones are widely regarded as functional learning tools across teacher education.

Association Between Smartphone Use Frequency and Perceived Learning Benefit

A chi-square test of independence examined the relationship between smartphone use frequency and perceived learning benefit. The association was statistically significant, $\chi^2(16) = 45.38$, $p < .001$, with a small to moderate effect size, Cramér's $V = .21$. Pre-service teachers who reported more frequent academic use were more likely to perceive smartphones as beneficial for learning. Because the design is cross-sectional, the direction of this relationship cannot be established: more frequent use may strengthen perceived value, or students who already regard the device as useful may use it more.

Impact on Focus and Learning Engagement Among Pre-Service Teachers

Distraction during lectures emerged as a non-trivial issue. Although smartphones were used predominantly for academic purposes, evidence of dual use was apparent. Most respondents reported using the device to access learning material such as PDF files, presentation slides or the learning management system (76.5%, n = 199), while others reported information searching (15.0%, n = 39) and academic communication through messaging platforms (4.6%, n = 12). A smaller group (3.8%, n = 10) reported other uses, including non-academic applications.

This distribution suggests that, despite the dominance of academic-related use, smartphone engagement during lectures often involves simultaneous or shifting attention across multiple functions, rather than sustained focus on a single learning activity. Importantly, this dual-use pattern was observed across all pre-service teacher disciplines, indicating that challenges related to attention management and self-regulation are shared concerns in pre-service teacher education rather than discipline-specific issues.

Challenges and Need for Guidance in Pre-Service Teacher Education

Limited internet data access was the most frequently reported challenge, cited by approximately 55% of respondents ($n \approx 143$), followed by distraction from non-academic applications, reported by around 42% ($n \approx 109$). Across all clusters, between 40% and 55% of pre-service teachers reported at least one significant challenge when using smartphones during lectures, indicating that infrastructural and behavioural constraints are widespread rather than isolated.

Responses regarding the need for guidance further revealed a divided pattern. Slightly over half of the respondents (approximately 52%, n ≈ 135) indicated that explicit training or institutional guidance is necessary to support effective and responsible smartphone use in learning contexts. In contrast, about 48% (n ≈ 125) perceived themselves as sufficiently capable of managing smartphone use independently. This near-even distribution highlights substantial variation in digital self-regulation and pedagogical readiness among pre-service teachers, suggesting that while some future teachers feel confident in navigating smartphone use autonomously, a comparable proportion still require structured support. The finding of this research can be summed up on Figure 1.

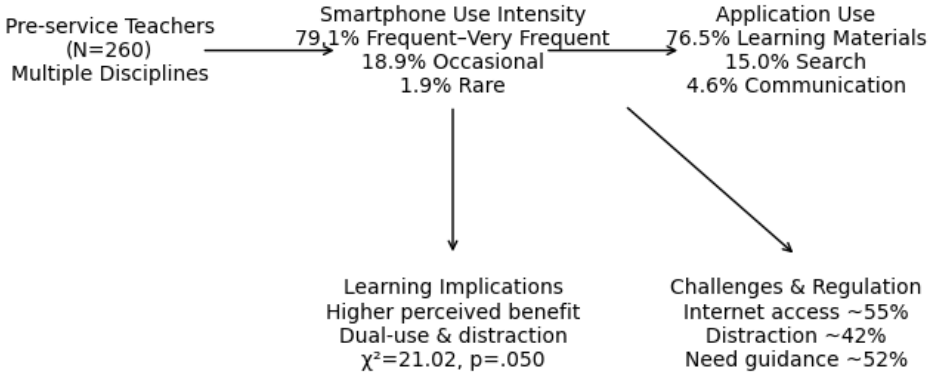

Figure 1. Framework of Smartphone Use and Learning Dynamics Among Pre-Service Teachers

Taken together, the results show that smartphone use is embedded in pre-service teacher education and that the frequency of academic use is associated with perceived learning benefit, while disciplinary variation, distraction and limited data access qualify that association.

2. Research Discussion

Smartphones as a Structurally Embedded Learning Infrastructure

The findings of this study demonstrate that smartphones have become a structurally embedded component of learning within pre-service teacher education rather than a peripheral or supplementary tool. The high proportion of participants reporting frequent to very frequent smartphone use during lectures indicates that mobile devices function as a default learning infrastructure through which academic tasks, information access, and communication are mediated. This pattern is consistent with prior research identifying smartphones as the most pervasive educational technology in higher education due to their portability, accessibility, and integration into daily routines (Crompton & Burke, 2018; Tong et al., 2023).

The study also shows that use is not merely prevalent but associated with perceived benefit. The significant relationship between frequency and perceived learning benefit suggests that smartphones are experienced as pedagogically valuable when used intensively for academic work, which is consistent with adoption research identifying perceived usefulness as a determinant of sustained engagement with mobile learning (İslamoğlu et al., 2021). The effect size, however, was small to moderate, and the association should not be read as evidence that more use produces better learning. Reviews of mobile learning outcomes indicate that frequency is a poor proxy for learning gain when use is fragmented or weakly regulated (Palalas & Wark, 2020; Tong et al., 2023). The educational value of the device lies less in how often it is used than in how purposefully it is integrated into instruction.

Disciplinary Variation in Smartphone Use Intensity

The study also found disciplinary variation in the intensity of use. Smartphones were used across all programmes, but students in language- and technology-oriented disciplines reported higher levels of frequent use than those in practice-oriented programmes such as Physical Education. This is consistent with task and technology fit perspectives, in which adoption follows the alignment between learning tasks and technological affordances (Sophonhiranrak, 2021; Tong et al., 2023). Disciplines built around textual engagement, online resources and digital communication invite more intensive use than those built around physical performance and direct supervision. The weak effect size nevertheless indicates that discipline explains only part of the variation, and that individual habit and access conditions also matter.

However, an important insight from this study is that although intensity differed across disciplines, attention-related challenges associated with smartphone use were evident across all program groups. This indicates that disciplinary context influences how often smartphones are used, but does not eliminate the cognitive and behavioral challenges associated with their presence in learning environments. Such findings reinforce the view that digital distraction is a cross-disciplinary phenomenon driven by broader cognitive and technological dynamics rather than by subject-specific practices alone.

Dual-Use Behavior and Attention Switching During Learning

A central contribution of this study lies in its identification of dual-use smartphone behavior during lectures. While most participants reported using smartphones for academic purposes, a notable proportion simultaneously engaged in activities such as information searching, messaging, or other non-academic applications. This pattern reflects an attention-switching environment in which learners frequently move between multiple functions within a single device.

This is consistent with experimental work showing that smartphone notifications, and even the mere presence of a smartphone, reduce available attentional and working memory resources independently of active use (Ward et al., 2017; Skowronek et al., 2023). The coexistence of perceived benefit and reported distraction in the present data is therefore not contradictory: both arise from the same technological ecology, in which the device simultaneously affords access to learning resources and imposes an attentional cost.

By foregrounding this dual-system dynamic, the present study moves beyond binary narratives that frame smartphones as either beneficial or harmful. Instead, it positions smartphone use as a complex interaction between pedagogical affordances and attentional demands, emphasizing the need for instructional designs that actively manage this tension.

Structural and Infrastructural Constraints on Smartphone-Based Learning

Beyond behavioral factors, the findings highlight the critical role of structural constraints in shaping smartphone-supported learning. Limited internet data access emerged as the most frequently reported challenge, surpassing distraction-related concerns. This finding underscores that mobile learning effectiveness is not solely determined by individual self-regulation, but also by infrastructural conditions that enable or constrain access to digital resources.

This result aligns with prior systematic reviews identifying connectivity, cost, and data affordability as major barriers to mobile learning in higher education, particularly in resource-constrained contexts (Sophonhiranrak, 2021; Tong et al., 2023). Limited internet access may restrict engagement with video-based materials, synchronous learning activities, and collaborative platforms, thereby reducing the pedagogical potential of smartphone use. These findings suggest that smartphone integration strategies must address infrastructural inequities alongside pedagogical considerations to ensure more equitable and effective learning experiences.

Contextual Conditions Shaping Smartphone Use

The results also need to be read against the conditions in which they were produced. West Kalimantan is a province in which network quality and data affordability decline sharply with distance from Pontianak, and a substantial share of students at the institution commute from or

return regularly to districts where coverage is intermittent. That the most frequently reported challenge was limited data rather than distraction is consistent with this socio-economic and geographical profile, and it suggests that findings from settings with subsidised campus connectivity may not transfer directly. Household income constrains both the volume of data students can purchase and the specification of the devices they own, so infrastructural disadvantage is likely to compound rather than sit alongside economic disadvantage.

Cultural and institutional norms are a second contextual condition. In many Indonesian classrooms, open device use during a lecture is read as inattentiveness to the lecturer, so students may use smartphones discreetly for legitimate academic purposes; self-reported behaviour may thus understate academic use and overstate the clarity of the boundary between academic and non-academic activity. Policy is a third condition. Indonesian higher education institutions retain considerable discretion over classroom technology rules, and in the absence of an institution-wide policy, practice is set lecturer by lecturer. The near-even split in students' stated need for guidance is intelligible in this light: where norms are set individually rather than institutionally, some students encounter explicit expectations and others must construct their own. Comparative work across provinces and policy regimes would help establish which of these findings are general and which are local.

Digital Self-Regulation and the Need for Guided Integration

The near-even split in participants' views on the need for institutional guidance points to marked heterogeneity in digital readiness. Roughly half indicated a need for explicit training or guidance, while the remainder considered themselves capable of managing smartphone use independently. This split reflects variation in digital self-regulation, a factor repeatedly shown to condition the effectiveness of mobile learning environments (Palalas & Wark, 2020). It is also worth noting that self-assessed capability and actual regulatory capacity need not coincide, so the group reporting no need for guidance is not necessarily the group least at risk of fragmented attention.

In the context of teacher education, this heterogeneity has important professional implications. Pre-service teachers are future educators whose beliefs, habits, and competencies regarding technology use are likely to shape their instructional practices. Research on teacher professional identity emphasizes that digital competence and technology-related beliefs contribute to teachers' sense of efficacy and professional orientation (Bülbül & Özelçi, 2025). From this perspective, smartphone use during teacher preparation functions as an implicit curriculum through which norms of digital professionalism and attention management are internalized.

These findings suggest that unguided smartphone integration may inadvertently normalize fragmented attention, whereas structured and reflective integration can support both learning and professional development. Differentiated support models that acknowledge varying levels of digital self-regulation may therefore be more effective than uniform policies that assume equal readiness among all pre-service teachers.

Implications for Policy, Practice, and Research

Taken together, the findings argue against binary policy approaches that treat smartphones as devices to be either prohibited or left unregulated. They point instead towards guided, discipline-sensitive and infrastructure-aware integration: smartphone-supported activities designed into the lesson rather than tolerated alongside it, shared norms for notification management during class, tiered support calibrated to students' self-regulation readiness, and institutional measures that address data cost and connectivity directly. For teacher education specifically, these measures carry a second function, since the norms modelled during preparation are the norms graduates are likely to reproduce in their own classrooms.

These findings extend the literature in three respects. They show that smartphones operate simultaneously as learning facilitators and attention-switching devices, which explains why benefit and distraction coexist in the same population; they foreground data affordability rather than distraction as the leading practical constraint in this setting; and they document uneven

digital self-regulation among pre-service teachers, which argues for differentiated rather than uniform institutional responses.

Several limitations qualify these conclusions. All measures were self-reported, so use frequency and perceived benefit may be subject to recall and social desirability bias; objective measures such as application tracking would provide a firmer basis. The cross-sectional design permits association but not causal inference, and the sample was drawn from a single institution, which limits generalisation to other regions and institutional types. The survey format also cannot recover the reasoning behind reported behaviour, and the present study therefore reports patterns rather than the experiences that produce them. Future work should address these limitations through longitudinal or experimental designs, multi-institution sampling, and a qualitative phase using interviews or focus groups with pre-service teachers to examine how they decide when device use serves learning and when it displaces it. Examining demographic and socio-economic moderators would further clarify how individual and structural factors jointly shape mobile learning.

D. CONCLUSION AND SUGGESTIONS

This study examined how pre-service teachers use smartphones during lectures, the learning benefits they perceive, the variation in those patterns across disciplines, and the challenges and support needs that accompany use. Smartphone use was highly prevalent, with 79.1% of respondents reporting frequent to very frequent academic use, mainly to access learning material and complete assignments. Use frequency was significantly associated with perceived learning benefit, $\chi^2(16) = 45.38$, $p < .001$, $V = .21$, while the association between disciplinary cluster and use frequency was weak and lay at the conventional threshold, $\chi^2(12) = 21.02$, $p = .050$, $V = .16$. Limited internet data and distraction from non-academic applications were the most frequently reported constraints, and respondents were almost evenly divided over whether they needed institutional guidance. Smartphones in this setting therefore operate as a learning infrastructure that affords access and imposes attentional cost at the same time, and attention-related difficulty was reported across every disciplinary cluster rather than being confined to any one of them.

These results suggest that policies which either prohibit or fully permit smartphone use are unlikely to serve teacher education well. What the evidence supports is guided, discipline-sensitive and infrastructure-aware integration: purposefully designed smartphone-supported activities, explicit norms for attention and notification management, differentiated support that recognises uneven self-regulation, and institutional attention to data cost and connectivity. Because the study is cross-sectional, self-reported and based at a single institution, these conclusions describe association rather than cause and require confirmation elsewhere. Longitudinal and multi-institution designs, objective measures of device use, and a qualitative phase examining how pre-service teachers judge when device use serves learning would strengthen the evidence base on which such policies can be built.

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