Human-Computer Interaction Design for Low-Literacy Users: A Framework for Inclusive Public Service Portals in Emerging Economies

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Abstract

Public services in emerging economies are moving online faster than the populations they serve are acquiring the textual, digital, and procedural literacies those services assume. The result is a paradox of digital governance: portals built to widen access instead erect new barriers for the citizens who depend on public services most. This paper synthesises three decades of human-computer interaction (HCI) research on low-literacy and first-time technology users into a design framework specifically targeted at government service portals. We first characterise the barrier landscape across four literacy dimensions — textual, digital, procedural, and linguistic — and show how conventional portal design compounds them. We then derive nine design principles, organised into perception (how information is presented), navigation (how users move through tasks), and trust (how users verify, recover, and seek help), and map each principle to concrete interface techniques with implementation notes for resource-constrained government IT environments. Finally, we propose an evaluation protocol combining task-based usability testing with assisted-use observation, reflecting the empirical reality that many low-literacy users access e-government through intermediaries. The framework offers portal designers, e-governance agencies, and civic technologists an actionable bridge between inclusive-design research and the procurement-driven practice of public sector software development.

Keywords: Human-computer interaction; Low literacy; E-government; Inclusive design; Public service portals; Emerging economies; Accessibility; Intermediated use.

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1. Introduction

Governments across South Asia, Africa, and Latin America have digitised welfare enrolment, land records, utility payments, grievance redressal, and identity services at remarkable speed. The efficiency case is strong: digital channels reduce leakage, queueing, and discretionary gatekeeping. But the design case has lagged behind. Most public service portals are, in effect, translated bureaucratic forms: dense text, official terminology, multi-step workflows, and error messages written for administrators rather than applicants. For the hundreds of millions of adults with limited reading fluency — and the larger population with limited digital experience — such portals convert a physical queue into a cognitive one.

HCI research has produced a substantial body of knowledge on designing for low-literacy users: text-free and icon-driven interfaces, voice interaction, video assistance, linear navigation, and intermediated-use models. Yet this knowledge remains poorly absorbed by the public sector, where portals are procured against functional specifications that rarely mention usability for marginal users, and where success is measured in transactions completed rather than in who completed them unaided. This paper addresses that translation

gap. Our research question is: which HCI design principles matter most for low-literacy users of public service portals, and how can they be operationalised within the constraints of government IT delivery? We contribute (i) a four-dimensional barrier model, (ii) a nine-principle design framework mapped to interface techniques (Table 1), and (iii) an evaluation protocol adapted to intermediated use.

2. Background

2.1 Literacy as a Multi-Dimensional Barrier

Treating "low literacy" as a single deficit obscures the distinct barriers users face. Textual literacy concerns decoding written words; users with limited textual literacy can often recognise numerals, logos, and familiar icons even when continuous prose is inaccessible. Digital literacy concerns operating the device and its interaction conventions — hierarchical menus, scrolling, form fields, back buttons — which are learned, not intuitive. Procedural literacy concerns understanding the bureaucratic process itself: which documents are needed, what an "application status" means, why a rejection occurred. Linguistic access concerns the gap between the portal's language (often English or a formal register of a national language) and the user's spoken vernacular. A portal can fail a user on any of these dimensions independently; robust design must address all four.

2.2 Lessons from Prior HCI Research

Foundational work on text-free user interfaces demonstrated that low-literacy users can complete non-trivial information tasks when interfaces rely on graphics, voice annotation, and minimal text, and that abstract icons perform worse than semi-realistic depictions of familiar objects and settings. Studies of speech interfaces for low-literate users found that spoken dialogue can outperform touch-tone and text navigation for first-time users, provided prompts are short, in local dialect, and tolerant of variation. Research on technology use in low-income communities has repeatedly documented intermediated use: family members, shopkeepers, cyber-café operators, and village-level entrepreneurs operate the interface on the beneficiary's behalf. Design that ignores the intermediary — for instance, by treating shared credentials purely as a security violation — misreads how access actually happens. Finally, general usability principles (visibility of system status, error prevention, recognition over recall) apply with amplified force: what is a minor irritation for a fluent user is often an abandonment point for a low-literacy user.

2.3 The Public Portal Context

Three contextual constraints distinguish government portals from commercial applications. Stakes are high: failure means a missed pension, not an abandoned shopping cart. Usage is episodic: a citizen may use a scholarship portal once a year, so learning does not accumulate. And delivery is procurement-driven: design decisions are fixed in tender documents and change orders are slow. A useful framework must therefore be expressible as specifiable requirements, not only as design sensibility.

3. Design Framework

We organise nine principles into three layers. Perception principles govern how content is presented; navigation principles govern how users move through tasks; trust principles govern verification, recovery, and help. Table 1 maps each principle to interface techniques and implementation notes suitable for inclusion in functional specifications.

Table 1. Design principles, interface techniques, and implementation notes for inclusive public portals

Layer	Principle	Interface Techniques	Implementation Notes
Perception	P1. Minimise reliance on continuous prose	Semi-realistic icons with short labels; numbers and colour coding; progressive disclosure of detail	Icon sets locally tested; never icon-only for critical actions
Perception	P2. Provide parallel audio	Tap-to-listen on every screen; voice-over of form fields and errors in local dialect	Pre-recorded human audio preferred over TTS where dialect TTS is weak
Perception	P3. Use the spoken vernacular	Vernacular-first language toggle; plain-language rewriting of legal terms with official term shown alongside	Maintain a bilingual glossary as a managed content asset
Navigation	P4. Linearise tasks	One question per screen; wizard flow with visible step indicator; no branching menus for core services	Deep links allow intermediaries to resume applications
Navigation	P5. Recognition over recall	Pre-filled data from registries; document checklists with images of each document type	Requires consent-based integration with identity/registry APIs
Navigation	P6. Prevent rather than punish errors	Input masks; on-field validation with spoken feedback; confirmation screens that read back entries aloud	Error messages must state the fix, not the fault code
Trust	P7. Make status legible	Visual status timeline (submitted → verified → approved) with dates; SMS/voice status callbacks	Status vocabulary limited to five citizen-tested terms
Trust	P8. Design for intermediated use	Assisted-mode with intermediary identification; receipt generation (print/SMS) naming the applicant	Log intermediary actions for accountability without blocking access
Trust	P9. Keep a human escape hatch	One-tap helpline callback; escalation to physical service centre with reference number carried over	Channel-switching must preserve application state

3.1 Perception Layer

The perception principles reject the assumption that reading is the default channel. P1 does not mean eliminating text — text anchors meaning for partially literate users and for intermediaries — but demoting it from sole carrier to one channel among several. P2 treats audio as a first-class equivalent of every visual element, which has architectural consequences: audio must be managed as versioned content, updated whenever screens change. P3 addresses the register problem: portals frequently offer a "local language" option

that is a formal, Sanskritised or bureaucratic register as inaccessible as English; the principle demands the spoken vernacular, validated with target users.

3.2 Navigation Layer

The navigation principles trade efficiency for certainty. Linear wizards (P4) are slower for expert users but dramatically reduce disorientation for episodic users, and a visible step indicator converts an opaque bureaucratic process into a bounded journey. P5 shifts burden from the user to the state: wherever government registries already hold a datum, the portal should present it for confirmation rather than demand re-entry. P6 reframes validation as dialogue; a read-back confirmation screen that speaks the entered details aloud catches errors that visually impaired-by-literacy users cannot proofread.

3.3 Trust Layer

The trust principles respond to the sociology of public services. Citizens abandoned by opaque processes rationally fall back on brokers and bribes; legible status (P7) is thus an anti-corruption feature, not cosmetic polish. P8 accepts intermediated use as a legitimate access pattern and designs accountability into it, rather than pretending every session is the applicant. P9 acknowledges that no interface serves everyone: the measure of an inclusive portal is not that no one needs help, but that needing help never means starting over.

4. Evaluation Protocol

Conventional usability testing under-measures the population of interest. We propose a three-component protocol. First, task-based testing with recruited low-literacy participants, using realistic service tasks (enrol, check status, respond to a rejection) and measuring unaided completion, assisted completion, and abandonment separately — collapsing these into a single completion rate hides exactly the differences that matter. Second, assisted-use observation at real access points (service centres, kiosks, shops), documenting how intermediaries and applicants divide the interaction and where authority and information asymmetries arise. Third, longitudinal re-testing after six to twelve months to capture the episodic-use problem: a portal is inclusive only if a citizen can return after a year and still succeed. Findings should be reported against the nine principles, turning the framework into an audit rubric that procurement bodies can reference in acceptance testing.

5. Discussion

Three tensions merit candour. First, security versus intermediation: identity systems increasingly demand biometric or OTP verification tied to the applicant, which collides with the reality of assisted use; resolving this requires designed roles for intermediaries, with delegated-consent mechanisms, rather than policies that force workarounds underground. Second, cost: parallel audio, vernacular content management, and assisted-mode features add real expense; but the comparison class should be the cost of exclusion — failed disbursements, grievance volumes, and the parallel paper channels that persist when digital channels fail marginal users. Third, measurement politics: agencies report transaction growth as success, yet growth can coexist with systematic exclusion of the least literate decile. The

disaggregated completion metrics in our protocol are therefore also a governance proposal: what agencies are required to measure shapes what vendors are required to build.

6. Conclusion

Public service portals are becoming the front door of the state. This paper argued that inclusive design for low-literacy users is neither charity nor edge-case accommodation but a core requirement of digital governance legitimacy, and it consolidated HCI research into a nine-principle framework spanning perception, navigation, and trust, expressed at the level of specifiable requirements. The framework's limitations point to future work: it requires field validation across service types and countries; the interaction between the framework and emerging voice-first and conversational interfaces deserves dedicated study; and the intermediation principles raise consent and accountability questions that connect HCI to administrative law. The direction, however, is clear: portals should be tested against the citizens with the least, not the most, literacy — because that is where the promise of digital government is either kept or broken.

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