The Current State Of Youth Digital Literacy: A Set Of Indicators And The Development Of A Local Index (Survey, Test, Factor Analysis)

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Abstract: This article presents a practical and psychometrically grounded approach to measuring the current state of youth digital literacy through a coherent indicator set and the construction of a Local Digital Literacy Index (LDLI). Building on international frameworks and assessment traditions, we combine a multi-construct instrument—covering information and data literacy, communication and collaboration, digital content creation, safety and well-being, and problem solving—with performance tasks and self-report scales. The study outlines the full pipeline from construct definition and item generation to piloting, reliability analysis, exploratory and confirmatory factor analysis, and index normalization. To guide replication in schools and youth centers, the paper introduces transparent scoring rules that balance interpretability and validity: domain scores are computed from graded tasks and calibrated self-reports, then aggregated using factor-score weights and scaled to a 0–100 metric. A feasibility pilot with secondary students illustrates expected benchmarks for internal consistency, sampling adequacy, and model fit, and demonstrates how the LDLI can reveal differences across demographic subgroups and access conditions without collapsing into a proxy for socio-economic status. The discussion emphasizes that digital literacy is not device familiarity but a transferable repertoire of cognitive, social, and ethical competencies that can be taught, assessed, and improved. Implications include establishing local monitoring cycles, aligning instruction with the most fragile domains, and using LDLI results to design targeted interventions rather than sorting students by ability.

Keywords: Digital literacy, indicator development, index construction, factor analysis, validity, youth, assessment.

Introduction: The spread of networked devices has redefined the competencies that young people need to learn, communicate, and participate safely in digital spaces. Yet the presence of technology does not ensure meaningful or equitable outcomes. Schools and community programs require reliable diagnostics that move beyond impressions about "digital natives" and capture the specific competencies that predict learning, resilience against online harms, and informed civic participation. International initiatives have converged on multidimensional models that treat digital literacy as a composite of information handling, communication and collaboration, content creation and reuse, safety and well-being, and problem solving in digital environments. Local systems, however, face two recurring challenges. First, imported instruments often fail to reflect linguistic, curricular, and infrastructural realities. Second, ad hoc surveys lack the psychometric rigor required for longitudinal monitoring and program evaluation.

This study addresses both challenges by proposing a context-sensitive indicator set and a replicable methodology for building a Local Digital Literacy Index (LDLI) that is compatible with established frameworks yet tuned to local instructional goals. Rather than equating digital literacy with device access or time online, the LDLI operationalizes competencies through observable behaviors in short performance tasks and calibrated self-reports, complemented by knowledge probes in areas like privacy settings, search strategies, and source evaluation. The approach emphasizes interpretable domain scores for teachers and policymakers while satisfying validity and reliability criteria customary in educational measurement.

The aim is to define and validate a local indicator system for youth digital literacy and to aggregate these indicators into a defensible index suitable for baseline estimation, subgroup diagnosis, and change monitoring. Specifically, the paper seeks to demonstrate a complete workflow that starts with construct definition and ends with a 0–100 scaled LDLI accompanied by domain profiles and confidence intervals that support actionable decisions in schools and youth programs.

Instrument design began with a mapping exercise that aligned widely used frameworks with local curricular strands and language practices. Constructs were represented through complementary modalities to reduce method bias: authentic performance tasks, such as locating a credible source under time constraints or configuring privacy options on a simulated platform; short, behaviorally anchored self-report items that ask about actual practices rather than attitudes; and discrete knowledge questions that assess foundational concepts of security, data handling, and intellectual property. Items were piloted in cognitive interviews with students to check wording comprehension and cultural fit, and reviewed by teachers and ICT coordinators to ensure curricular relevance.

The sampling frame targeted students in lower and upper secondary grades across urban and rural schools with varied connectivity profiles. Participation was organized through proctored classroom sessions using laptops or tablets provided by the study, with offline mirrors of web tasks to equalize conditions where connectivity was unstable. Performance tasks were scored with analytic rubrics on a three- or four-point scale, privileging criteria such as accuracy, efficiency, and evidence of strategy use. Self-reports used five-point frequency scales anchored to concrete behaviors, and knowledge items had keyed correct responses with randomized distractors. Alongside the main instrument, a short background questionnaire captured age, gender, language of instruction, device access at home, time online separated into academic and leisure activities, and prior media literacy instruction.

Psychometric analyses followed established steps. Internal consistency was estimated with Cronbach's alpha for each domain, complemented by item-rest correlations to identify weak items. Sampling adequacy for factor analysis was examined through the Kaiser–Meyer–Olkin statistic and the Bartlett test of sphericity. Exploratory factor analysis (EFA) with polychoric correlations was used in the pilot to verify whether items clustered into the theorized domains when method effects were controlled. Factor retention was guided by parallel analysis and the minimum-average-partial criterion. A reduced item set was then subjected to confirmatory factor analysis (CFA) on a held-out subsample to test the five-domain structure, with model fit evaluated via comparative fit index, Tucker–Lewis index, root mean square error of approximation, and standardized root mean square residual. Residual diagnostics and modification indices informed small respecifications only when theoretically justified, for example, correlating residuals among items that share a stem.

To construct the LDLI, we combined domain-level factor scores using two aggregation strategies. The primary method applied regression-based factor scores from the CFA and normalized the weighted composite to a 0–100 scale to support communication. As a sensitivity check, we computed an equal-weighted composite of standardized domain means to ensure that results were not artifacts of factor-score estimation. Standard errors for the composite were obtained through nonparametric bootstrap resampling at the classroom level to reflect clustering. Subgroup contrasts by gender, grade, and access profile were examined using multiple regression with robust standard errors, controlling for school fixed effects to reduce confounding.

The entire pipeline was documented to be reproducible with common statistical software. Consent procedures followed school policies, and tasks avoided logging personal accounts or real-life data. To keep the instrument practical for schools, administration time was limited to two class periods, with adaptive routing that shortened the self-report battery when performance tasks yielded clear evidence about a domain.

Construct coherence emerged as the primary criterion for accepting or revising the indicator set. In the feasibility pilot, internal consistency coefficients for performance-based domain scales generally met or exceeded customary thresholds. Items intended to capture information and data literacy showed strong corrected item–total correlations, suggesting that tasks such as identifying the least biased source or refining a search query were measuring a common underlying competency. Communication and collaboration items reflected a blend of etiquette, platform functions, and participatory norms, and initially exhibited signs of method effects when self-report items dominated; introducing short situational judgments and a micro-simulation of group document editing improved convergence between modalities. Digital content creation, defined in terms of transforming and remixing material with attribution and accessibility in mind, benefited from tasks in which students produced a short captioned visual explanation of a concept, which

proved more discriminating than multiple-choice questions about licenses. Safety and well-being integrated privacy management, cyber hygiene, and emotional self-regulation in response to online conflict; here, knowledge probes about phishing signals and settings were insufficient by themselves, and direct observation of choices in simulated inboxes provided clearer evidence. Problem solving in digital environments, particularly the ability to transfer procedures from one application to another and debug simple process breakdowns, showed the strongest association with overall index scores, consistent with the view that strategic flexibility amplifies returns on other competencies.

EFA supported a five-factor solution aligned with the conceptual model, and parallel analysis discouraged over-factoring despite moderate cross-loadings between information handling and problem solving, an overlap that is theoretically defensible. The KMO statistic indicated meritorious sampling adequacy, and Bartlett's test rejected the null of an identity matrix, confirming that the correlation structure was suitable for reduction. After pruning items with low communalities or salient cross-loadings, the CFA on the validation sample achieved acceptable fit on all indices, with the best model allowing correlated residuals among two creation items that shared a common scoring rubric. Factor loadings were highest for performance tasks that demanded visible strategy use and for self-reports anchored to recent, verifiable behaviors, a pattern that reinforces the need to avoid purely attitudinal measures.

The index behaved as intended. Scaling to a 0–100 metric preserved the relative distances among domain scores and made reporting intuitive for educators and youth workers. The factor-weighted composite and the equal-weighted composite were highly correlated, which suggests that policy conclusions are robust to the aggregation method. Subgroup analysis revealed small, non-significant differences by gender when access was controlled, undermining stereotypes about innate digital affinity. Grade-level differences reflected curricular exposure more than age per se, and the largest disparities appeared between students with stable, supervised access and those with sporadic or exclusively mobile access. Crucially, background regression models indicated that while socio-economic indicators predicted access and some self-report behaviors, they did not fully account for performance on strategy-intensive tasks, implying that instruction can close a substantial portion of the observed gaps.

From an instructional perspective, domain profiles were more actionable than the composite. Schools used the safety and well-being results to identify specific misconceptions about privacy settings and to prioritize short, scenario-based lessons on phishing and consent. Information and data literacy scores highlighted the value of teaching source evaluation heuristics and structured search techniques early in the curriculum. Content creation findings encouraged explicit instruction on attribution, text–image integration, and accessibility features such as captions and alt text. Communication and collaboration evidence inspired classroom norms for platform use that integrate etiquette with practical skills like version control in shared documents. Problem solving scores became a catalyst for embedding metacognitive prompts that nudge students to articulate procedures and transfer them across applications, reinforcing the notion that digital literacy is as much about adaptability as it is about tool-specific knowledge.

Validity arguments rested on multiple strands of evidence. Content validity was established through expert review and curricular alignment; internal structure validity was supported by factor-analytic results; and relations with other variables were consistent with theoretically expected patterns, including moderate associations with reading comprehension and self-regulated learning strategies. Test–retest reliability over a short interval was satisfactory for performance tasks and higher for the self-report scales, which is unsurprising given that behaviors can vary with recent classroom assignments. Importantly, differential item functioning analyses by gender and language of instruction identified a small number of items with bias, which were revised or replaced; for example, vocabulary that was idiomatic in one language proved ambiguous in another, an issue addressed through parallel item development with bilingual panels.

The study underscores that the LDLI is a decision-support tool rather than an identity label. Aggregate scores should guide the allocation of instructional time and resources, not rank students in ways that limit opportunity. When used in a monitoring cycle, the index can detect changes after short interventions, provided that tasks are rotated and parallel forms are equated to avoid practice effects. Program designers can set targets such as increasing safety and well-being scores by a specified amount over a semester and can track whether improvements concentrate among previously underserved groups, thereby aligning digital literacy efforts with equity goals.

Two limitations deserve emphasis. First, although the indicator set is broadly aligned with international frameworks, local curricular priorities may evolve, requiring periodic refresh of tasks and descriptors. The LDLI is designed to be modular for this reason, allowing

domains to be updated without rebuilding the entire instrument. Second, while performance tasks strengthen validity, they are costlier to administer and score than self-reports; the compromise adopted here—short, rubric-based tasks with automated logging of key actions—keeps administration feasible within two class periods, but scaling to a district requires capacity building and quality control. Future work should explore computer-based adaptive testing that tailors task difficulty, as well as longitudinal designs that estimate growth trajectories and their relation to academic outcomes and well-being.

A coherent, locally grounded measurement system for youth digital literacy is both feasible and valuable. By defining competencies through observable behavior, aligning indicators with curricula, and validating structure through factor analysis, the LDLI provides schools and youth programs with a defensible baseline and a compass for improvement. The index's interpretability allows educators to see which domains require attention, while its psychometric underpinnings enable credible monitoring and evaluation. When used responsibly—paired with teacher professional development, student-facing feedback, and targeted supports—the LDLI can help shift the conversation from access to capability and from assumptions about "digital natives" to evidence about teachable, equitable competencies.

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