A STAGED METHODOLOGY FOR INTEGRATING ICT IN INCLUSIVE PRIMARY CLASSROOMS

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Abstract. Information and communication technology (ICT) is widely promoted as a means of widening participation for learners with special educational needs (SEN), yet reviews of the field consistently report that classroom adoption remains uneven and weakly connected to instructional decision-making. This paper narrows the question from "does assistive technology work?" to "how should a general-education primary teacher decide which digital tool to use, and when?" Ten peer-reviewed systematic reviews, meta-analyses and large-scale studies published between 2019 and 2025 were synthesised; reported enablers and barriers were coded and mapped onto the Universal Design for Learning (UDL) framework and the instructional cycle. The synthesis confirms moderate positive achievement effects for UDL-based instruction and consistent gains in engagement and participation from assistive technology, while identifying four recurrent barriers: limited teacher digital competence, fragmented institutional support, tool selection driven by availability rather than learner need, and the under-representation of primary settings in the evidence base. A five-stage model — *diagnose, select, implement, consolidate, evaluate* — is proposed, each stage governed by a decision rule linking a documented access barrier to a technology function rather than to a device.

Keywords: inclusive education; special educational needs; ICT integration; assistive technology; Universal Design for Learning; teacher digital competence; primary education.

1. Introduction

Inclusive education requires that learners with special educational needs (SEN) pursue the same curricular goals as their peers, in the same classroom. Digital technology is routinely presented as the instrument that makes this possible, because it can represent content in several modalities, adapt pacing to the individual, and offer alternative means of expression to learners whose sensory, communicative, cognitive or motor profiles make conventional tasks inaccessible.

The evidence broadly supports the claim. A systematic review of thirty-one empirical studies found that assistive technology (AT) increases the accessibility and inclusion of students with disabilities (Fernández-Batanero et al., 2022a); a review of twenty-six studies identified AT as an enabler of academic engagement and participation with measurable psychosocial benefits (McNicholl et al., 2021); and a PRISMA-based review of ninety-three primary studies reported screen readers, braille devices and augmented reality as the technologies most frequently deployed in inclusive settings (Samaniego López et al., 2025).

The same reviews converge on a less encouraging finding: effectiveness is not a property of the device but of the match between a technology and a documented learner need.

Insufficient teacher training is the barrier reported most often (Fernández-Batanero et al., 2022a; McNicholl et al., 2021), and a recent scoping review characterises integration for students with disabilities as inconsistent and confined to fragmented initiatives without durable institutional support (Murillo-Jiménez et al., 2025). Cranmer (2020) likewise describes disabled children's own digital practices as an opportunity that schools largely fail to build on.

Two gaps follow. Existing reviews establish which technologies are used and whether they help, but say little about the sequence of pedagogical decisions by which a non-specialist teacher arrives at a tool; and the evidence base is skewed towards secondary and tertiary education, with childhood and primary settings accounting for a small fraction of reviewed studies (Fernández-Batanero et al., 2022a). This paper therefore restricts its scope to general-education primary classrooms (grades 1–4) in which learners with SEN are taught alongside peers by non-specialist teachers using mainstream rather than high-cost specialised devices. It asks: (RQ1) which enablers and barriers recur across recent secondary evidence? and (RQ2) how can these be organised into a model usable by a primary classroom teacher?

2. Methodology

The study is a conceptual paper built on an integrative synthesis of secondary evidence rather than on new empirical data. Sources were identified in Scopus, Web of Science and ERIC using combinations of the terms inclusive education, special educational needs, assistive technology, ICT integration and universal design for learning. Inclusion criteria were: (a) systematic review, meta-analysis or large-scale empirical study; (b) peer-reviewed and published in English between 2019 and 2025; (c) concerned with settings in which learners with SEN are taught in mainstream provision; and (d) reporting both outcomes and implementation conditions. Technical papers describing device engineering without an instructional dimension were excluded. Ten sources met all criteria.

Analysis proceeded in two steps. First, each source was coded inductively for reported enablers and barriers, and codes recurring in three or more independent sources were retained. Second, the retained codes were mapped deductively onto two frames: the three UDL principles of multiple means of representation, expression and engagement, and the instructional cycle of assessment, planning, delivery, consolidation and evaluation. Their intersection generated the model in Section 3.3.

Three limitations should be stated. As a review of reviews, the primary-study samples of the included sources partially overlap, so effect estimates are not independent. The synthesis covers only English-language indexed literature, excluding national research published in Uzbek. Finally, the model is derived analytically and has not been tested empirically.

3. Results and Discussion

3.1. What the evidence supports

Technology-supported inclusive instruction shows a consistent but moderate positive effect. A meta-analysis of twenty studies yielding fifty individual effects reported a moderate combined effect of UDL-based instruction on academic achievement (g = 0.43) for learners from pre-kindergarten to adulthood (King-Sears et al., 2023). A parallel meta-analysis found that implementing all three UDL principles together produced larger gains than implementing one or two, while cautioning that heterogeneity was considerable and publication bias could not be excluded (Almeqdad et al., 2023). Reviews of assistive technology report gains not only in attainment but in engagement, independence and social participation (McNicholl et al., 2021; Mukhtarkyzy et al., 2025). The magnitude matters for practice: these effects are large enough to justify systematic use, but not large enough to survive careless implementation.

3.2. Recurrent barriers

Four barrier codes recurred in three or more sources. The first is teacher digital competence: generic ICT skills are widespread, while the specific competence to adapt technology for learners with disabilities remains underdeveloped (Fernández-Batanero et al., 2022a, 2022b). The second is institutional fragmentation, with integration proceeding through isolated projects rather than sustained policy (Murillo-Jiménez et al., 2025). The third is availability-driven selection: tools are chosen because a school owns them, not because a learner profile calls for them, a pattern visible in the concentration of reported technologies around a narrow set of devices (Navas-Bonilla et al., 2025; Samaniego López et al., 2025). The fourth is stigma, which McNicholl et al. (2021) address by recommending that mainstream devices be harnessed as assistive technology for all students, reducing the visibility of individual adaptation.

3.3. A five-stage methodological model

Mapping these findings onto the instructional cycle yields five stages, each governed by a decision rule linking a documented need to a technology function rather than to a named product.

(1) Diagnose. The teacher records what the learner cannot currently do in a specific curricular task, expressed as an access barrier (for example, “cannot decode printed text at task pace”) rather than as a diagnostic label. This preserves the shift, central to UDL, from the deficit of the learner to the barrier in the instruction.

(2) Select. The barrier is matched to a required function — alternative representation, alternative expression, or scaffolded engagement. Only once the function is fixed is a tool chosen, and mainstream tools available to the whole class are preferred over dedicated devices in order to limit stigma and cost (McNicholl et al., 2021).

(3) Implement. The tool is embedded in a task that retains the same learning objective for every learner, with differentiation located in the route rather than in the goal.

(4) Consolidate. Interactive exercises, digital tasks and educational games allow repetition at a learner-controlled pace, exploiting the capacity for review and replay that reviews associate with gains in independence and self-efficacy (Mukhtarkyzy et al., 2025).

(5) Evaluate. Change is assessed against the barrier recorded at stage one, not against the class norm, and the outcome feeds back into the next selection decision. Without this loop, tool use becomes habitual rather than responsive.

3.4. Implications for teacher education

If effectiveness depends on the decision sequence rather than on the device, teacher preparation should be organised around that sequence. Programmes that train teachers in software operation address none of the four barriers identified above; programmes that train teachers to state a barrier, specify a function and evaluate against the original barrier address three of them directly. This reframes teacher digital competence in inclusive education as a diagnostic and design competence rather than a technical one — consistent with evidence that UDL-focused professional development produces measurable classroom change (Almeqdad et al., 2023; King-Sears et al., 2023).

4. Conclusion

Recent secondary evidence establishes that ICT and assistive technology improve access, engagement and, more modestly, attainment for learners with special educational needs in mainstream settings, but that these gains are conditional on how the teacher selects and sequences the tools. The barriers reported most consistently are pedagogical and institutional rather than technical.

The five-stage model proposed here — diagnose, select, implement, consolidate, evaluate — makes that selection logic explicit and teachable for non-specialist primary teachers, the group least represented in the current evidence base. Its limitation is that it remains analytically derived; the next step is a classroom trial in primary inclusive settings, measuring both learner participation and the fidelity with which teachers apply the decision rules. Understood in this way, ICT in inclusive education is not the technologisation of teaching but a means of realising a single principle: one learning goal, many routes to it.

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