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Beyond Technocentrism in AI-Supported Special Education: The PAISEN Model of Teacher-Mediated Inclusive Learning

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ABSTRACT

Artificial intelligence (AI) offers new possibilities for inclusive teaching and learning for students with special educational needs (SEN), yet AI-in-SEN research remains largely technocentric, often describing system capabilities without explaining how outputs become pedagogically meaningful. This conceptual paper develops the PAISEN Model (Pedagogical Artificial Intelligence for Special Education Needs) through an integrative synthesis of AI in education, inclusive pedagogy, Universal Design for Learning (UDL), and assistive technology. The model proposes a non-deterministic sequence in which AI Teaching Support Systems provide data and adaptive affordances, Teacher Pedagogical Mediation interprets and contextualises them, and an Inclusive Learning Environment translates decisions into accessible participation opportunities. SEN learning outcomes are treated as proposed consequences rather than established effects. Teacher AI competency, institutional support, digital infrastructure, and learner characteristics function as boundary conditions, while an adaptive feedback loop links learner evidence to teacher reflection and instructional adjustment. The novelty of PAISEN lies in making teacher judgement the central explanatory mechanism and separating technology, pedagogical processes, learning conditions and moderators. Theoretically, it bridges AIED and inclusive education; pedagogically, it clarifies differentiated and UDL-aligned AI use without replacing teacher agency; practically, it provides a testable structure for implementation and evaluation. The proposed relationships require empirical validation in authentic SEN settings.

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1. Introduction

Artificial intelligence (AI) is increasingly embedded in contemporary education through adaptive instruction, automated feedback, intelligent tutoring, learning analytics and personalised learning pathways (Zainudin, 2024; Alfarwan, 2025). These developments have generated interest because AI can process learner data at scale and potentially expand access to differentiated support (Holmes et al., 2019; Holmes and Tuomi, 2022). In inclusive education, this potential is especially significant because students with special educational needs (SEN) may require flexible representations, communication supports and varied pathways for participation. This agenda is consistent with Sustainable Development Goal 4, which prioritises inclusive and equitable quality education (UN, 2025; Adipat and Chotikapanich, 2022). However, accessibility is not produced by technology alone; it depends on whether technological affordances are translated into pedagogically appropriate opportunities for participation.

Students with SEN may encounter barriers in conventional classrooms associated with cognitive processing, communication, sensory access and social interaction (Al-Ahmed, 2025; Saxton et al., 2025). AI-enabled tools such as speech recognition, predictive text, adaptive learning platforms, captioning, learning analytics and communication systems have consequently been proposed to support a range of disability-related and learning needs (Kooli and Chakraoui, 2025; Ayobami et al., 2024). These technologies can alter the form, pace and accessibility of instructional materials, but their educational value remains contingent on how teachers interpret system outputs, connect them to curricular intentions and respond to the learner in context. A recommendation generated by an algorithm is therefore not equivalent to an instructional decision, and personalised content is not necessarily inclusive if it isolates learners, narrows participation or fails to account for communication, relational and ethical dimensions of classroom life.

Despite rapid technological development, research on AI in SEN remains conceptually fragmented. A substantial part of the literature describes what AI systems can do - for example, adapt content, identify patterns or automate feedback - while giving less attention to the pedagogical mechanisms through which these capabilities become meaningful in inclusive classrooms (Wulandari et al., 2024; Farhah et al., 2025; Walter, 2025). In parallel, inclusive pedagogy and Universal Design for Learning (UDL) emphasise teacher judgement, participation, differentiated support and multiple means of engagement, representation and expression, yet these traditions do not by themselves specify how AI-generated information should enter teacher decision-making (Florian and Linklater, 2010; Strogilos et al., 2023; Yermakova et al., 2025). The resulting gap is not simply a shortage of AI tools, but the absence of a clear conceptual account that distinguishes technological affordances, teacher interpretation, the inclusive learning environment, learner outcomes and the contextual conditions that may strengthen or constrain these relationships. This paper therefore develops the PAISEN Model (Pedagogical Artificial Intelligence for Special Education Needs) to address the question: how can AI teaching support systems be linked conceptually to teacher pedagogical mediation, inclusive learning conditions and proposed SEN learning outcomes without treating technology as an independent causal agent? The model positions teacher judgement as the central explanatory mechanism and specifies empirically testable pathways, moderators and an adaptive feedback loop.

2. Literature Review

2.1 Theoretical Foundations

2.1.1 Inclusive Pedagogy

Inclusive pedagogy provides a foundational lens for special education because it shifts the focus from correcting learner deficits to extending meaningful participation in common learning experiences (Black-Hawkins, 2017; Morina and Orozco, 2021). This orientation has direct implications for AI design and use. An AI system is pedagogically inclusive not merely because it produces personalised content, but because its outputs help teachers widen access, sustain participation and avoid unnecessarily separating learners from shared curricular experiences. Flexible resources, differentiated instruction, collaborative learning and adaptive assessment can support this purpose

(Mrema, 2024), yet their appropriateness depends on professional judgement. Teachers must interpret AI-generated recommendations in relation to curriculum goals, learner communication preferences, sensory and cognitive needs, classroom relationships and ethical considerations. In this sense, teacher judgement mediates between computational recommendation and pedagogical action: the system may identify a pattern, but the teacher decides whether the pattern is educationally meaningful, whether an intervention is appropriate and how it should be enacted. AI can therefore support inclusive teaching when it expands the teacher's repertoire of accessible representations, scaffolds and feedback while preserving teacher agency and learner participation (Julien, 2024). This distinction is central to PAISEN because it separates technical personalisation from pedagogically mediated inclusion.

2.1.2 Universal Design for Learning (UDL)

UDL strengthens this argument by treating accessibility as a design principle rather than a later accommodation. It encourages educators to anticipate learner variability and provide multiple means of representation, engagement, and action and expression (Priyadharsini and Mary, 2024; Catama, 2025; Wea et al., 2025). AI can extend these possibilities by adjusting reading levels, converting text to speech, generating alternative explanations and recommending activities based on learner data (Julien, 2026; Ibrahim et al., 2025). Nevertheless, an important conceptual distinction remains: UDL specifies what an inclusive learning environment should enable, whereas AI supplies potential adaptive capabilities. The two are not interchangeable. When AI is used without UDL-informed pedagogical judgement, personalisation may optimise task completion without necessarily increasing access, belonging or participation. In PAISEN, UDL therefore informs the inclusive learning environment as a proximal pedagogical condition through which teacher-mediated AI use may create accessible opportunities for learning (Taylor and Rojas Ramirez, 2024; Guo and Wang, 2025).

2.2 AI in Education: Emerging Opportunities

AI in education (AIED) has expanded through adaptive learning systems, intelligent tutoring, predictive analytics, natural language processing and automated feedback (Holmes et al., 2019; Divya, 2026). By processing learner data, these systems can identify patterns, recommend instructional resources and support timely responses to emerging difficulties (Holmes and Tuomi, 2022; Patel et al., 2025). Recent studies associate adaptive systems with differentiated and personalised learning pathways (Cunha et al., 2025; Luckin et al., 2022). Yet the AIED literature also exposes a recurring limitation: system capability is often treated as if it were synonymous with instructional effectiveness. Technological responsiveness does not establish pedagogical appropriateness, and predictive accuracy does not determine how a teacher should act. Effective integration therefore requires a conceptual bridge between AI-generated information and situated teacher decision-making (Zawacki-Richter et al., 2022). PAISEN uses AIED to define the enabling technological layer of the model, while deliberately locating pedagogical interpretation outside the technology itself.

2.3 AI Applications in SEN

AI applications in SEN demonstrate substantial functional diversity, including speech recognition, text-to-speech, learning analytics, adaptive tutoring and tools supporting communication or social learning (Kotevski, 2025; Song and Mao, 2024; Paglialunga and Melogno, 2025; Lan et al., 2025). Such studies are important because they show how particular technologies may reduce specific access barriers. However, evidence organised by tool type can fragment the pedagogical picture: a speech-recognition system, an adaptive platform and an autism-support application operate differently, yet all still require decisions about when, why and for whom they should be used. The conceptual problem is therefore cross-cutting. AI support becomes educationally meaningful only when teachers connect technical affordances to learner goals and inclusive classroom participation. This explains why PAISEN does not classify technologies as direct determinants of outcomes; it treats them as inputs whose value is shaped by teacher mediation and the learning environment.

2.4 Assistive Technology and AI-Supported Learning

Assistive technology has long supported students with disabilities by improving access to information, communication and participation through tools such as screen readers, communication devices, visual supports and adaptive input systems (Restianty et al., 2024). AI can make such supports more responsive by analysing interaction patterns, adapting materials and generating real-time assistance (Joshi, 2025). Examples include adaptive reading support (Algamdi, 2026), language and communication assistance using natural language processing (Zhang et al., 2024), real-time captioning (Al-Aizari, 2025) and visual-recognition support for learners with visual impairment (Filipova, 2025). The critical issue is that increased technical adaptivity does not remove the need for pedagogical integration. Assistive functions may reduce an access barrier, but teachers still determine how the support is embedded in learning activities, whether it promotes autonomy rather than dependence, and whether it enables participation alongside peers. This literature therefore contributes the accessibility dimension of PAISEN while reinforcing the need for teacher-guided implementation (Kooli and Chakraoui, 2025).

2.5 Pedagogical Challenges in Integrating AI in SEN

A persistent challenge in AI-supported SEN is technocentrism: the tendency to privilege algorithmic efficiency, automation and data processing while under-specifying the pedagogical work required to support diverse learners (Judijanto et al., 2025; Dumitru et al., 2025; Fitas, 2025). Teacher readiness is therefore not a peripheral implementation issue. Educators require technological knowledge, pedagogical knowledge and the capacity to interrogate AI-generated recommendations rather than apply them uncritically (Zulkifli et al., 2026; Aravantinos et al., 2026). Institutional conditions also matter because training, leadership, accessible infrastructure and technical support determine whether teachers can use AI consistently and responsibly. Ethical concerns - including privacy, algorithmic bias, equitable access and the risk of misinterpreting students with disabilities - further constrain implementation (Floridi et al., 2018; Zhao et al., 2025). Overreliance on automation may also weaken human interaction and collaborative learning that are central to inclusive education (Abubakar et al., 2025; Aisy and Aprilia, 2025). These challenges suggest that contextual factors should be conceptualised as boundary conditions that alter the feasibility and strength of AI-supported practice rather than as steps in the pedagogical process itself.

2.6 Critical Synthesis and Conceptual Gap

Across the four bodies of literature reviewed above, a consistent conceptual separation is visible. AIED explains technological capabilities; assistive-technology research explains barrier-reducing functions; inclusive pedagogy explains the normative and professional logic of teaching for learner diversity; and UDL explains how learning environments can be designed for variability. What remains insufficiently specified is the relationship among these domains. Existing work commonly moves from AI capability to anticipated learner benefit without clearly identifying the intervening pedagogical mechanisms, or it discusses inclusion without specifying how AI-generated information is evaluated and enacted by teachers. The literature also tends to treat implementation conditions - such as teacher competence, institutional support and infrastructure - as general challenges rather than theoretically distinct moderators. PAISEN is therefore necessary as an integrative model because it separates (a) technological affordances, (b) teacher pedagogical mediation, (c) the inclusive learning environment, (d) proposed learner outcomes, (e) contextual and learner-level boundary conditions, and (f) an iterative feedback process. This architecture makes the model empirically testable while avoiding the assumption that AI produces educational outcomes independently of pedagogy.

3. Methodology: Conceptual Model Development Approach

This study adopts an integrative conceptual-development approach to construct the PAISEN Model from the interdisciplinary literature reviewed in the manuscript. The purpose is theory building rather than effect estimation. Accordingly, the paper does not claim to be a systematic review or meta-analysis and does not use PRISMA-style procedures. Instead, the conceptual corpus combines foundational and recent work in four domains that are directly

relevant to the research problem: AIED, inclusive pedagogy, UDL and assistive technology. These domains were selected because each explains a different part of the problem - technological capability, pedagogical judgement, inclusive learning design and accessibility support - and because their integration is necessary to address the technocentric gap identified in the literature.

3.1 Analytical Synthesis Procedure

The synthesis proceeded in three analytical stages. First, recurring constructs were extracted from the reviewed literature, including AI-enabled adaptation and analytics, teacher interpretation and scaffolding, accessible and multimodal learning conditions, learner participation and achievement, and implementation constraints. Second, these constructs were compared according to their conceptual function: enabling technology, pedagogical mechanism, proximal learning condition, proposed outcome or boundary condition. Third, relational logic was developed by asking what must occur between an AI-generated recommendation and an observable learning opportunity. This comparison positioned teacher pedagogical mediation as the first intervening mechanism and the inclusive learning environment as the second, while teacher AI competency, institutional support, digital infrastructure and learner characteristics were retained as moderators because they are expected to alter the strength or feasibility of the proposed relationships rather than transmit the effect themselves.

3.2 Model-Building Logic and Evidential Boundaries

The final model was organised as a sequential but non-deterministic pathway from AI Teaching Support Systems to Teacher Pedagogical Mediation, Inclusive Learning Environment and SEN Student Learning Outcomes, with an adaptive feedback loop connecting learner evidence to teacher reflection and instructional adjustment. The arrows in the model represent theoretically proposed relationships derived from conceptual synthesis; they do not constitute evidence of causality, statistical mediation or moderation. The terms mediator and moderator are therefore used as propositions to be tested empirically. This explicit boundary is important because the manuscript develops a framework for future investigation rather than reporting an intervention trial or measured learning effects.

4. Conceptual Model Development: The PAISEN Model

The PAISEN Model (Pedagogical Artificial Intelligence for Special Education Needs) conceptualises AI as an enabling teaching support rather than an autonomous instructional agent. Its distinctive logic is that technological capability becomes educationally meaningful only through pedagogical interpretation and an inclusive learning context. The model therefore specifies a proposed pathway from AI Teaching Support Systems to Teacher Pedagogical Mediation and then to an Inclusive Learning Environment, from which learner outcomes may emerge. It also distinguishes contextual and learner-level moderators from the mediating process and incorporates a feedback loop through which learner evidence can inform subsequent teacher reflection and instructional adjustment. These relationships are conceptual propositions and require empirical testing.

4.1 Conceptual Foundations of the PAISEN Model

The PAISEN Model is grounded in the premise that AI should augment, not displace, teacher agency. AIED contributes adaptive learning, tutoring and analytics; inclusive pedagogy contributes the principle of extending participation to diverse learners; UDL contributes the design of flexible representation, engagement and expression; and assistive technology contributes barrier-reducing functions. PAISEN differs from a simple aggregation of these perspectives by assigning each a role within one explanatory architecture. AI provides data and adaptive affordances, teachers interpret and transform those affordances into instructional action, inclusive environments provide the conditions through which learners can participate, and contextual factors define the conditions under which this process may be more or less viable (Holmes and Tuomi, 2022; Kooli and Chakraoui, 2025).

4.2 AI Teaching Support Systems

AI Teaching Support Systems form the enabling technological layer of PAISEN. They include adaptive learning platforms, speech-recognition tools, intelligent tutoring systems and learning analytics (Ayobami et al., 2024; Dennis, 2024; Farhah et al., 2025; Levin, 2024). These systems may detect patterns, adapt content, generate feedback or recommend additional support. In PAISEN, however, such outputs are treated as informational and adaptive affordances rather than pedagogical decisions. A system can indicate that a learner is struggling with a concept or has disengaged from a task (Johar et al., 2023; Joshi, 2025), but it cannot by itself determine the educational meaning of that pattern or the most appropriate classroom response. This distinction prevents the model from assigning direct causal power to the technology and establishes the rationale for the next stage: teacher pedagogical mediation.

4.3 Teacher Pedagogical Mediation

Teacher Pedagogical Mediation is positioned as the first proposed mediator because it describes the necessary transformation from AI output to instructional action. AI-generated data, predictions or recommendations do not enter learning unchanged; teachers interpret them in relation to curriculum, prior knowledge, communication needs, learner preferences, classroom relationships and professional judgement. This interpretation may lead to scaffolding, differentiated instruction, adaptive feedback or a decision not to use a recommendation. Scaffolding can structure support as learners develop new knowledge (Chueng and Heng, 2025), while learning analytics may help teachers identify patterns that warrant further attention (Haider et al., 2025). The mediating role is therefore theoretical rather than statistically established: PAISEN proposes that teacher judgement explains how a technological affordance can be converted into a pedagogically defensible response. Without this conversion, AI remains a technical resource rather than an inclusive instructional practice (Kooli and Chakraoui, 2025; Sharmin et al., 2026).

4.4 Inclusive Learning Environment

The Inclusive Learning Environment is positioned as the second proposed mediator because teacher decisions must still be enacted through concrete opportunities for access, engagement and expression before they can plausibly relate to learner outcomes. Guided by UDL, this environment includes multimodal materials, accessibility tools, flexible participation and varied ways for learners to demonstrate understanding (Catama, 2025; Priyadharsini and Mary, 2024; Wea et al., 2025). AI may support these conditions by adapting text complexity, converting text to speech, generating visual explanations or personalising practice activities (Dennis, 2024; Zhang et al., 2024). The conceptual sequence is therefore important: teacher mediation determines how an AI affordance is used, while the inclusive environment is the proximal context in which that decision becomes accessible learning activity. The model does not assume that accessibility features automatically produce inclusion; inclusion depends on whether learners can participate meaningfully and equitably in the instructional experience (Guo and Wang, 2025).

4.5 Proposed SEN Student Learning Outcomes

PAISEN identifies engagement, cognitive development, communication, academic achievement and learning independence as proposed outcome domains rather than established effects. Existing studies suggest that adaptive learning and AI-supported accessibility can be associated with improved engagement, differentiated practice and access to communication or written content (Cunha et al., 2025; Kotevski, 2025; Paglialunga and Melogno, 2025). However, these findings arise from heterogeneous tools and learner groups and should not be generalised as proof that the PAISEN pathway produces improvement. The model instead proposes that any relationship between AI support and learner outcomes should be examined through the intervening pedagogical processes specified above. Future empirical work should therefore measure not only outcomes, but also the quality of teacher mediation and the inclusiveness of the learning environment.

4.6 Moderating Conditions in the PAISEN Model

PAISEN distinguishes moderators from mediators to clarify their theoretical function. Teacher AI competency, school leadership and institutional support, and digital infrastructure are conceptualised as contextual moderators because

they can strengthen, weaken or constrain the implementation of the proposed pathway without constituting the pathway itself (Aravantinos et al., 2026; Zulkifli et al., 2026). For example, strong AI competency may improve a teacher's capacity to interrogate system recommendations, whereas weak infrastructure may interrupt access regardless of pedagogical intent. Learner-level characteristics - including disability type, cognitive profile and learning readiness - are likewise treated as moderators because the usefulness and accessibility of a particular AI affordance may vary across learners (Alam et al., 2026; Julien, 2026). These moderating effects remain propositions. Their purpose in the model is to make boundary conditions explicit and to discourage one-size-fits-all assumptions about AI-supported SEN practice.

4.7 Feedback and Adaptive Learning Loop

The feedback and adaptive learning loop represents an iterative information cycle rather than a separate causal effect. Learner performance, engagement and access data may be captured through learning analytics (Aravantinos et al., 2026), reviewed by teachers and used to reconsider instructional strategies. The loop therefore runs from learner evidence back to teacher reflection and subsequent adjustment of AI-supported activities. In practice, a teacher might revise the difficulty, modality or timing of an AI-supported task after observing that the learner's response differs from the system's recommendation. This iterative structure acknowledges that inclusive teaching is dynamic and that initial recommendations should remain open to professional revision (Divya, 2026).

4.8 Summary of the PAISEN Model

In summary, PAISEN separates technological affordance from pedagogical action and makes teacher judgement the central mechanism linking AI to inclusive practice. AI Teaching Support Systems provide data and adaptive possibilities; Teacher Pedagogical Mediation interprets and contextualises them; the Inclusive Learning Environment translates pedagogical decisions into accessible participation opportunities; and learner outcomes are treated as proposed distal consequences. Contextual and learner-level factors moderate the viability of these relationships, while the feedback loop allows learner evidence to inform subsequent instructional adjustment. The model is therefore intended as a testable conceptual architecture, not as evidence that AI integration necessarily improves SEN learning.

Figure 1

The PAISEN Model of Teacher-Mediated and Contextually Moderated Inclusive Learning

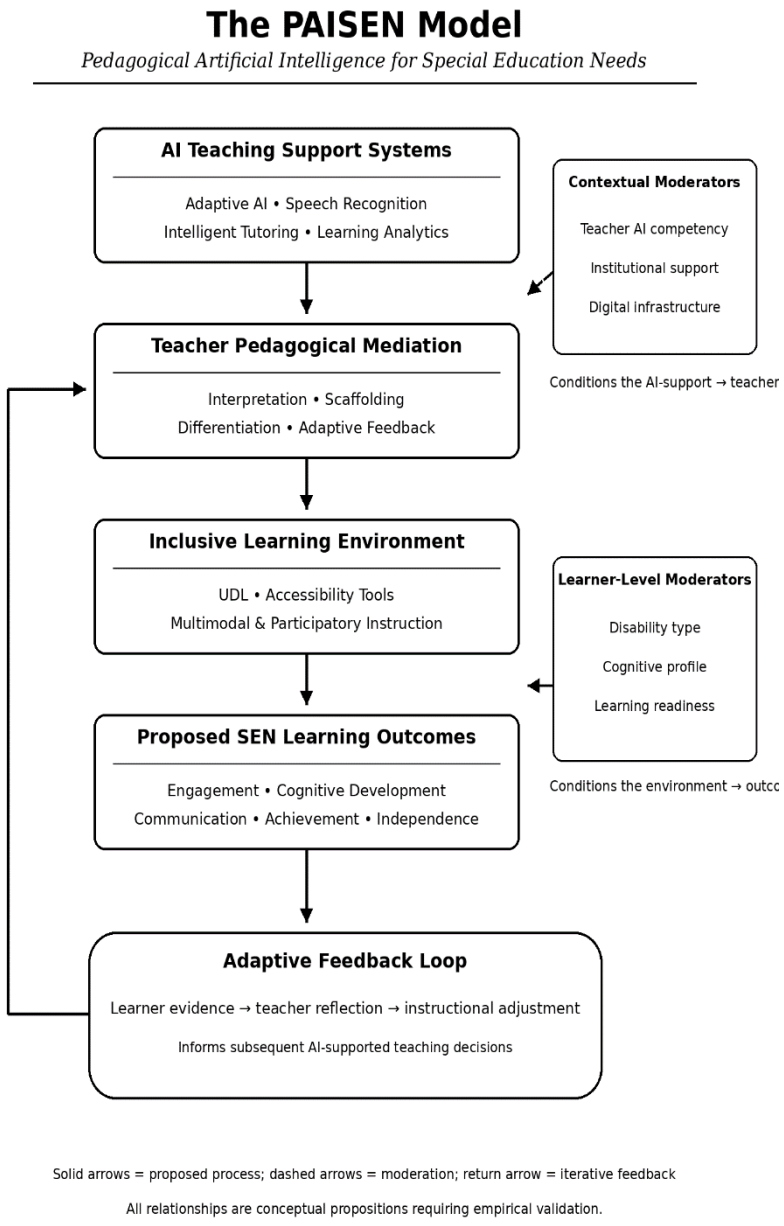

Figure 1 presents the PAISEN Model as a set of theoretically proposed relationships. Solid arrows show the main process sequence from AI Teaching Support Systems to Teacher Pedagogical Mediation, then to the Inclusive Learning Environment and proposed SEN Student Learning Outcomes. Dashed arrows identify moderation rather than direct effects: teacher AI competency, institutional support and digital infrastructure are proposed to condition the AI-support-to-teacher-mediation relationship, while disability type, cognitive profile and learning readiness are proposed to condition the relationship between the inclusive learning environment and learner outcomes. The return arrow represents an adaptive feedback cycle in which learner evidence informs teacher reflection and subsequent

instructional adjustment. These directions express conceptual propositions only; the figure does not establish causal, mediating or moderating effects.

5. Discussion

The PAISEN Model addresses the central problem identified in the literature by explaining why AI capability alone is insufficient as a theory of inclusive learning. AIED and assistive-technology studies provide important evidence about adaptation, automation and accessibility, but they can leave the teacher's interpretive work implicit. Inclusive pedagogy and UDL, by contrast, make participation, flexibility and teacher judgement central but do not inherently specify how algorithmic outputs should be evaluated within instructional decision-making. PAISEN links these traditions by locating teacher pedagogical mediation between technical affordance and inclusive practice. This is the model's principal distinction from tool-centred frameworks: the explanatory unit is not the AI application itself, but the teacher-mediated process through which an application may become educationally useful.

5.1 Theoretical Rationale for Mediators and Moderators

The proposed mediators and moderators perform different conceptual functions. Teacher pedagogical mediation is positioned first because AI outputs must be interpreted before they can guide teaching. The inclusive learning environment is positioned second because interpreted decisions must be enacted through accessible materials, interactions and participation opportunities before any learner outcome can reasonably be expected. Contextual factors are treated as moderators rather than mediators because competency, institutional support and infrastructure do not themselves translate AI output into instruction; instead, they influence whether and how strongly that translation can occur. Learner characteristics are similarly treated as moderators because the same AI-supported strategy may be more or less accessible or useful for different learners. This architecture makes the model's relational claims explicit and provides hypotheses that can be examined rather than assumed.

5.2 Distinctiveness, Scope and Limitations of the Conceptual Model

PAISEN is distinct in combining six elements within one pedagogically ordered structure: AI affordances, teacher mediation, inclusive learning conditions, proposed learner outcomes, contextual and learner-level moderators, and an adaptive feedback loop. Its contribution is integrative rather than a claim to replace UDL, inclusive pedagogy or existing AIED frameworks. At the same time, the model has clear limitations. It has not yet been empirically validated, its proposed pathways should not be interpreted as causal, and the heterogeneity of SEN means that no single technology or instructional sequence can be assumed to work uniformly across learners or settings. School policy, resource levels, cultural expectations and data-governance requirements may also shape implementation differently across contexts. These limitations make empirical testing and contextual adaptation essential before the model is used to support strong claims about learning effects.

6. Implications for Practice and Policy

Because PAISEN is conceptual, its implications should be understood as design and implementation priorities to be examined in practice rather than as demonstrated effects. For educators, the model suggests that professional learning should combine AI literacy with inclusive pedagogy, UDL, critical interpretation of learner data and ethical decision-making. Training should therefore move beyond operating specific tools to evaluating whether an AI recommendation is appropriate for a learner, how it can be translated into scaffolding or differentiated instruction, and whether it increases meaningful participation. For school leaders, the model highlights the importance of accessible infrastructure, technical support, protected time for teacher learning and procedures for evaluating AI tools before classroom adoption. From a policy perspective, the framework suggests that procurement and implementation guidelines should assess pedagogical alignment, accessibility, privacy, bias and equitable access rather than technical performance alone. Policies should also preserve teacher accountability for instructional decisions and encourage collaboration among educators, learners, families, researchers and technology developers. If future evidence supports the proposed relationships, PAISEN could provide a common structure for connecting AI

investment to professional learning and inclusive design. Until such validation is available, the model is best used as a planning and research framework rather than as proof that AI implementation will improve SEN outcomes.

7. Contributions of the PAISEN Model

The PAISEN Model makes three related contributions. Theoretically, it bridges AIED, inclusive pedagogy, UDL and assistive technology by specifying a relational architecture in which AI affordances are separated from the teacher judgement and inclusive learning conditions through which they may become educationally meaningful. This makes explicit a mechanism that is often implicit in technocentric accounts and introduces contextual and learner-level boundary conditions into the same model. Pedagogically, PAISEN clarifies that personalisation is not equivalent to inclusion: AI supports inclusive teaching only when teachers use it to widen access, participation, scaffolding and multimodal engagement while retaining professional judgement. Practically, the model offers a structure that can guide implementation planning, professional learning and empirical evaluation by identifying what should be measured beyond the presence of an AI tool. Its distinctiveness therefore lies not in proposing another category of educational technology, but in organising technology, teacher agency, inclusive design, outcomes, moderators and feedback into a testable teacher-mediated framework.

8. Future Research Directions

Future research should test PAISEN in staged, context-sensitive studies. First, measurement work is needed to operationalise AI Teaching Support Systems, the quality of Teacher Pedagogical Mediation, the inclusiveness of the learning environment and the proposed outcome domains. Content validation with special educators, learners, families and accessibility specialists would help ensure that these constructs reflect authentic SEN practice. Second, quantitative studies could examine the sequential indirect pathway from AI support to teacher mediation, inclusive learning conditions and learner outcomes using structural equation modelling; multilevel designs would be preferable where learners are nested within teachers or schools. Moderation by teacher AI competency, institutional support, infrastructure and learner characteristics should be tested as interaction effects rather than assumed from the conceptual diagram. Third, qualitative classroom observation, teacher interviews and learner or family perspectives could examine how AI recommendations are accepted, modified or rejected and how these decisions affect participation. Fourth, quasi-experimental or longitudinal studies could compare teacher-mediated AI implementation with tool-only or usual-practice conditions while tracking engagement, accessibility, communication and academic outcomes over time. Mixed-method designs would be particularly useful for explaining why the same technology produces different experiences across disability profiles and school contexts. Throughout this work, researchers should report data-governance procedures, accessibility considerations and unintended effects, because empirical support for the model depends on both educational effectiveness and responsible implementation.

9. Conclusion

The expansion of AI in education creates significant possibilities for supporting learners with SEN, but technological capability should not be treated as a substitute for pedagogical reasoning. This conceptual paper developed the PAISEN Model to explain how AI-supported special education may be understood through a teacher-mediated and contextually conditioned process. The model distinguishes AI Teaching Support Systems from Teacher Pedagogical Mediation, the Inclusive Learning Environment and proposed SEN Student Learning Outcomes, while also specifying contextual and learner-level moderators and an adaptive feedback loop. Its central proposition is that AI-generated information becomes educationally meaningful only when teachers interpret it, align it with inclusive pedagogical goals and enact it through accessible learning opportunities. PAISEN therefore contributes an integrative structure that connects AIED with inclusive pedagogy, UDL and assistive technology without assuming that technology independently produces improved outcomes. Because the model has not yet been empirically tested, its pathways should be treated as hypotheses for future research rather than established causal relationships. Validation in

authentic educational settings will be necessary to determine when, how and for whom the proposed framework is useful.

Declarations

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None.

Competing Interests
None.

Ethical Approval
This study was granted an exemption from requiring ethics approval as it does not involve human participants or the collection of sensitive personal data. The research is based on bibliometric methods, utilizing secondary data exclusively from the Scopus/WoS database. As such, it adheres to institutional guidelines that classify this type of study as low-risk and not subject to formal ethics approval.

Author Contributions
Author[1]: Conceptualization, Data curation, Formal analysis, Writing – original draft
Author[2]: Resources, Supervision, Investigation, Validation, Visualization, Writing – review and editing

Data Availability
None.

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