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Toward a Conceptual Taxonomy of Cognitive Load Theory Applications in Special Education

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ABSTRACT

Cognitive Load Theory (CLT) has spread across special education research in the past decade, touching reading, writing, mathematics, assessment, teacher training, and assistive technology. This growth is good news, but it has happened without any shared system for organizing it. Different researchers use the same theory to study very different things, and there is currently no map that shows how these applications relate to one another. This paper responds to that gap by proposing a conceptual taxonomy of CLT applications in special education. It explains why taxonomies matter for a growing field, reviews the scattered applications that already exist, sets out the principles used to build the taxonomy, and presents seven domains, instructional, assessment, learner-specific, teacher, technology, research, and system-level applications, along with the relationships among them. The paper closes with a discussion of how the taxonomy could benefit different groups working in this space and how it should be refined through international and cross-cultural input over time. The taxonomy proposed here is a starting point rather than a finished product, meant to give researchers a shared language rather than a fixed set of rules.

1. Introduction

Cognitive Load Theory has grown from a fairly narrow account of problem solving into one of the most widely cited frameworks in educational psychology. Sweller and colleagues have kept refining it for nearly four decades, most recently by giving sharper definitions to element interactivity and by connecting the theory more explicitly to motivation and self-regulated learning (Chen et al., 2023; Sweller et al., 2019; Hanham et al., 2023). Special education research has grown alongside it, though along its own separate path, driven by decades of work on learning disabilities, sensory impairment, intellectual disability, and neurodevelopmental conditions such as autism and ADHD. For most of that history, these two fields developed largely apart from one another.

That separation has started to close. Researchers now apply CLT to teaching reading to children with dyslexia, to designing handwriting interventions for dysgraphia, to building adaptive software for students with intellectual disability, and to training the teachers who work with all of these learners (Kennedy & Romig, 2021; Danna et al., 2023; Almufareh et al., 2023). This is a genuinely encouraging development. But it has also created a new problem, one that is easy to miss because each individual study looks reasonable on its own. The applications of CLT in special education are multiplying faster than anyone is organizing them. A study on cognitive load in autism and a study on cognitive load in teacher training might both cite Sweller, both use the language of intrinsic and extraneous load, and yet have almost nothing else in common in terms of purpose, method, or intended audience. Nobody has yet stepped back to ask how these different strands of work relate to each other, or whether some parts of the emerging picture are being studied heavily while other parts sit almost untouched.

This paper argues that special education research on CLT has reached the point where it needs an organizing framework, not because the existing work is flawed, but because it has become too large and too varied to hold in mind without one. Although applications of Cognitive Load Theory in special education continue to expand, there is currently no comprehensive taxonomy to organize this emerging body of knowledge.

Timing matters here. A taxonomy proposed too early, before enough work exists to classify, tends to feel arbitrary and gets ignored. A taxonomy proposed too late, after a field has already settled into informal habits of talking about itself, tends to face resistance because researchers have grown comfortable with existing, if messy, ways of describing their work. The moment this paper is written sits somewhere in between. There is now enough published work connecting CLT to special education, spanning reading, writing, mathematics, assessment, technology, and teacher training, to make classification genuinely useful rather than premature. At the same time, no dominant informal convention has yet taken hold, which means a proposed taxonomy still has a real chance of shaping how the field organizes itself going forward rather than simply describing a structure that already exists in everyone's head.

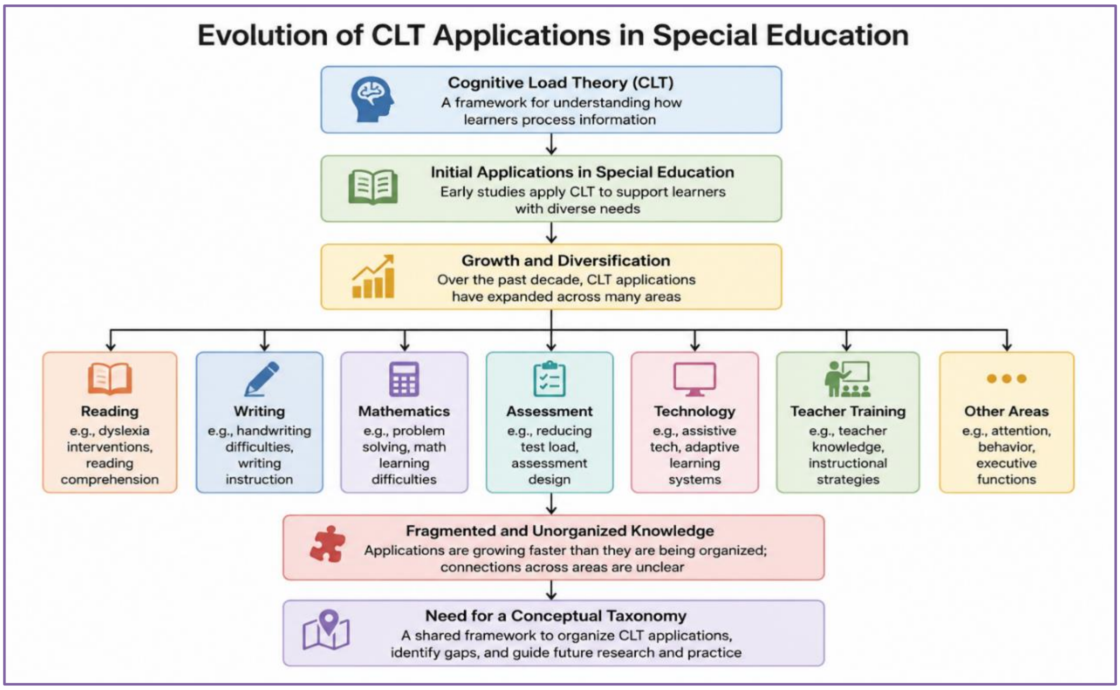
The rest of this paper works toward closing that gap. Section two explains why taxonomies matter for a field at this stage of growth, drawing on examples from other disciplines. Section three surveys the scattered applications of CLT already visible in special education research. Section four lays out the principles used to build a defensible taxonomy. Section five presents the taxonomy itself, organized into seven domains. Section six explains how these domains relate to one another rather than standing apart. Section seven works through illustrative examples showing how real studies would be classified. Section eight discusses who stands to benefit from having this kind of shared structure. Section nine is honest about the taxonomy's current limitations and what refinement it still needs. Section ten closes the paper.

2. Why Taxonomies Matter

A taxonomy is, at its simplest, a way of sorting a large and growing body of knowledge into categories that make sense to the people using it. This might sound like a modest administrative task, but taxonomies have played a much larger role in the history of science than that description suggests. Biology could not have organized itself around evolutionary relationships without Linnaeus's classification system giving researchers a shared way to name and group organisms in the first place. Medicine relies on classification systems such as the International Classification of

Diseases to allow clinicians in different countries, working in different languages, to agree on what condition a patient actually has. Psychology and psychiatry depend on diagnostic manuals that, whatever their flaws, let researchers compare findings across studies because everyone is talking about the same category of disorder. Education has its own well-known example in Bloom's taxonomy of educational objectives, which gave generations of teachers and researchers a common vocabulary for talking about different levels of thinking, from simple recall to complex evaluation.

Figure 1. Evolution of CLT Applications in Special Education



What all of these examples share is a set of functions that go well beyond simple labeling. Taxonomies organize knowledge that would otherwise sit as an unconnected pile of individual findings. They create a common language, so that a researcher in one country and a researcher in another can be confident they mean the same thing when they use the same term. They facilitate collaboration, because shared categories make it much easier to see who else is working on a related problem. They guide future research, since a well-built taxonomy tends to reveal empty cells, areas nobody has studied yet, almost as clearly as it displays existing work. And they improve evidence synthesis, because systematic reviews and meta-analyses depend on being able to group similar studies together in the first place, something that is very hard to do reliably without an agreed classification scheme.

Special education research on cognitive load is arguably at exactly the stage where a taxonomy would help most. The field is past its earliest years, when a handful of scattered papers would not have justified the effort of formal classification. But it has not yet reached the kind of maturity where categories have settled naturally through decades of accumulated convention, the way they eventually did in biology or medicine. This in-between stage, enough activity to need organizing but not yet enough convention to have organized itself, is precisely when a proposed taxonomy tends to have the most influence, because it can shape how the field grows rather than simply describing growth that has already happened and hardened into habit.

It is worth being honest about the limits of this argument too. A taxonomy imposed too early, or too rigidly, can distort a field rather than help it, forcing researchers to squeeze findings into categories that do not quite fit and discouraging the kind of boundary-crossing work that often produces the most interesting insights. The taxonomy proposed later in this paper tries to take that risk seriously by presenting itself explicitly as a starting point for discussion rather than a fixed system, and by building in a domain, the relationships among domains, that exists specifically to resist the idea that categories should be treated as walls rather than as loosely drawn regions on a shared map.

There is also a more immediate, practical cost to having no taxonomy at all, one that goes beyond abstract concerns about scientific organization. Consider a graduate student beginning a systematic review of CLT and special education. Without an agreed set of categories, that student has to build a search strategy from scratch, guess at which terms different research communities use for similar ideas, and risk missing entire strands of relevant work simply because those strands used different vocabulary. Consider a funding agency trying to decide where to direct a new grant program. Without a shared map of the field, that agency has no easy way to see whether a proposal fills a genuine gap or simply repeats work that already exists under a different name. These are not hypothetical inconveniences. They are the everyday, unglamorous costs of working in a field that has grown quickly but has not yet organized itself, and they are precisely the costs a taxonomy is meant to reduce.

3. Existing Applications of CLT in Special Education

Before proposing a way to organize this field, it helps to see just how scattered the existing applications already are. CLT has found its way into nearly every academic subject taught in special education classrooms, plus several areas that sit outside the traditional curriculum altogether.

Reading. Dyslexia research has increasingly framed reading difficulty as a working memory problem as much as a phonological one, since decoding consumes so much capacity that little remains for comprehension (Stein, 2023). This framing lines up naturally with CLT's core distinction between intrinsic and extraneous load, even in studies that do not use CLT vocabulary explicitly.

Writing. Dysgraphia research has moved in a similar direction, treating handwriting as a cognitively demanding motor and planning task rather than a purely physical skill (Danna et al., 2023; Shyika & Krilevych, 2021). Once handwriting is understood this way, CLT principles about protecting working memory during skill acquisition apply directly.

Mathematics. Dyscalculia research has perhaps engaged with CLT more directly than any other academic domain, partly because mathematical problem solving involves exactly the kind of multi-step element interactivity that CLT was built to describe. Ahuja et al. (2021) measured intrinsic, extraneous, and germane load directly in students with and without dyscalculia, and Mishra and Khan (2022) reviewed two decades of work connecting general cognitive processes, including working memory, to the disorder. What makes mathematics such fertile ground for CLT is that a single arithmetic procedure, long division, for instance, often requires a learner to hold several sub-steps in mind at once while also tracking where they are in the overall sequence. For a student with dyscalculia, that combination of holding and tracking can overwhelm working memory long before any conceptual misunderstanding comes into play, which is exactly the kind of problem CLT-informed instructional design, breaking the procedure into smaller, explicitly sequenced steps, is meant to solve.

Science. Science instruction for students with disabilities has received comparatively less direct CLT attention, though the underlying logic, that dense diagrams, unfamiliar vocabulary, and multi-step procedures create heavy intrinsic and extraneous load together, applies just as strongly here as it does in mathematics. Science textbooks in particular tend to combine several potential sources of extraneous load in a single page, unfamiliar terminology, dense diagrams, and long blocks of explanatory text competing for the same limited working memory. This is one of the emptier cells that a taxonomy would help reveal rather than hide, and it is worth naming explicitly here precisely because it is easy to overlook when nobody is tracking which academic subjects have and have not received sustained CLT attention.

Daily living skills. Instruction in functional and daily living skills for students with intellectual disability depends heavily on sequencing and pacing, both classic CLT concerns, even though very little published research frames this instruction explicitly in CLT terms (Gupta, 2022).

Communication. Learners with hearing impairment often manage several information channels at once, an interpreter, a speaker's lips, printed text, which is a direct real-world instance of the split-attention problem that CLT research has documented in laboratory settings for years (Bishop & Gregory, 2022).

Inclusive education. As more students with disabilities spend time in general education classrooms, CLT has started to appear in discussions of how to design instruction that works for the whole class rather than requiring separate materials for separate learners, though this application remains more discussed than empirically tested.

Teacher education. A small number of studies have applied CLT directly to how teachers are trained, testing whether cognitive load principles help or hinder teacher learning itself, not just the learning of the students those teachers will go on to teach (Timothy et al., 2023).

Technology. This is probably the fastest-growing application area, covering adaptive software for dyscalculia (Dhingra et al., 2022), artificial intelligence frameworks for intellectual disability (Almufareh et al., 2023), gesture-based interfaces for visually impaired users (Modanwal et al., 2022), and robot-assisted intervention for autism (So et al., 2023).

Assessment. New measurement tools, including theory-based questionnaires (Krieglstein et al., 2023) and broader surveys of workload measurement methods (Kosch et al., 2023), have started to make cognitive load something that can be assessed directly rather than only inferred from behavior.

These application areas did not emerge from any coordinated plan. Each grew out of its own disciplinary tradition, reading research talking mostly to other reading researchers, technology research talking mostly to other technology researchers, with only occasional overlap. The result is a body of work that is genuinely rich but also genuinely disconnected, which is exactly the condition that motivates the taxonomy proposed in the sections that follow.

It is worth pausing on just how uneven this growth has been. Mathematics and technology have attracted a disproportionate share of attention, likely because both lend themselves easily to controlled, quantifiable study designs that fit comfortably within existing research traditions in cognitive psychology and computer science. Daily living skills, communication, and system-level concerns such as policy have attracted far less, not because they matter less to the learners involved, but because they resist the same kind of tidy, quantifiable study design and instead require messier, more qualitative, or more longitudinal approaches that the field has not yet invested in heavily. A taxonomy cannot fix this imbalance on its own, but it can at least make the imbalance visible, which is itself a necessary first step toward correcting it.

4. Principles Guiding the Taxonomy

A taxonomy is only as useful as the logic behind it, so before presenting the categories themselves, it is worth being explicit about the criteria used to build them. A taxonomy built without stated criteria invites an obvious and fair criticism: why these categories and not some other set that would have sorted the same literature just as plausibly. Naming the principles up front is what makes the resulting structure something other researchers can evaluate, argue with, and eventually improve, rather than something they either accept or reject wholesale without being able to say exactly why. Six principles guided the taxonomy development process described in this paper.

Educational purpose. Categories were built around what the application is trying to accomplish, teaching a skill, measuring a construct, training a teacher, informing a policy, rather than around surface features like the subject being taught. This keeps the taxonomy from fragmenting into an unmanageable number of narrow, subject-specific categories.

Target population. Some applications concern a specific disability category directly, while others are population-neutral, applying in principle to any learner regardless of diagnosis. The taxonomy needed a way to hold both kinds of work without forcing population-neutral research into an artificial disability label it does not actually carry.

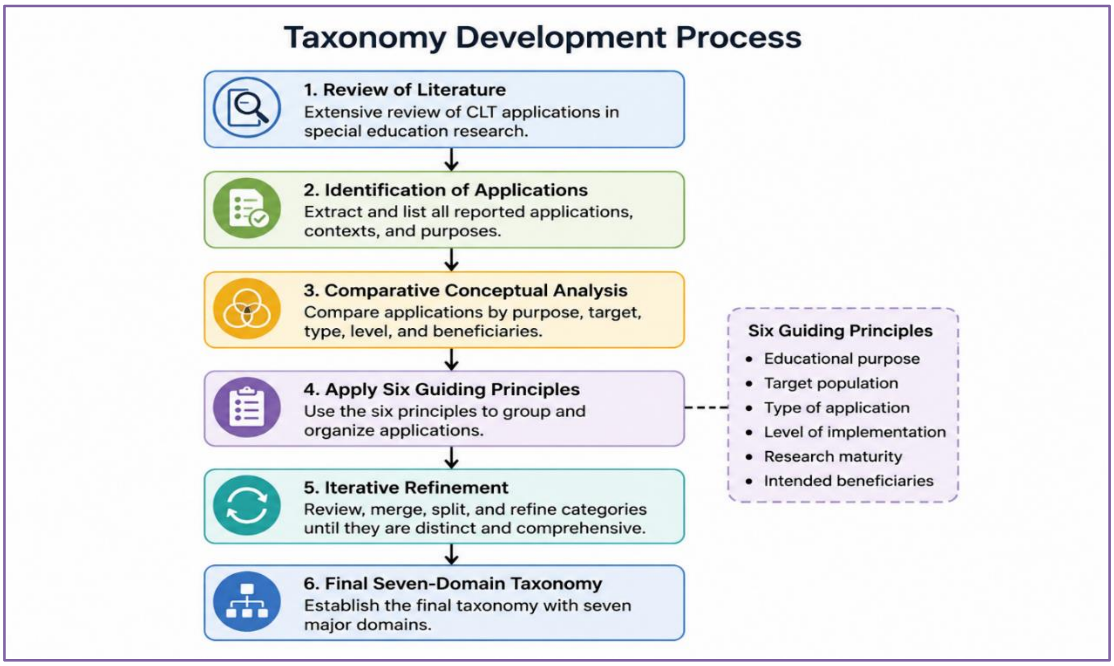
Type of application. A study that builds a new measurement instrument is doing something fundamentally different from a study that tests a classroom intervention, even if both use CLT language. Distinguishing conceptual, empirical, technological, and system-level applications from one another turned out to be one of the more useful organizing distinctions available.

Level of implementation. Applications range from the individual learner, an intervention for one child, up through the classroom, the school, and eventually the education system as a whole, where policy and national curriculum standards operate. A taxonomy that ignored this range would collapse very different kinds of work into the same category simply because they share a theoretical label.

Research maturity. Some applications rest on a reasonably solid empirical base, worked examples research being a good example (Barbieri et al., 2023), while others are still largely conceptual or exploratory, existing more as proposed frameworks than as tested interventions. Marking this distinction honestly, rather than treating every category as equally mature, keeps the taxonomy from overstating how settled the field actually is.

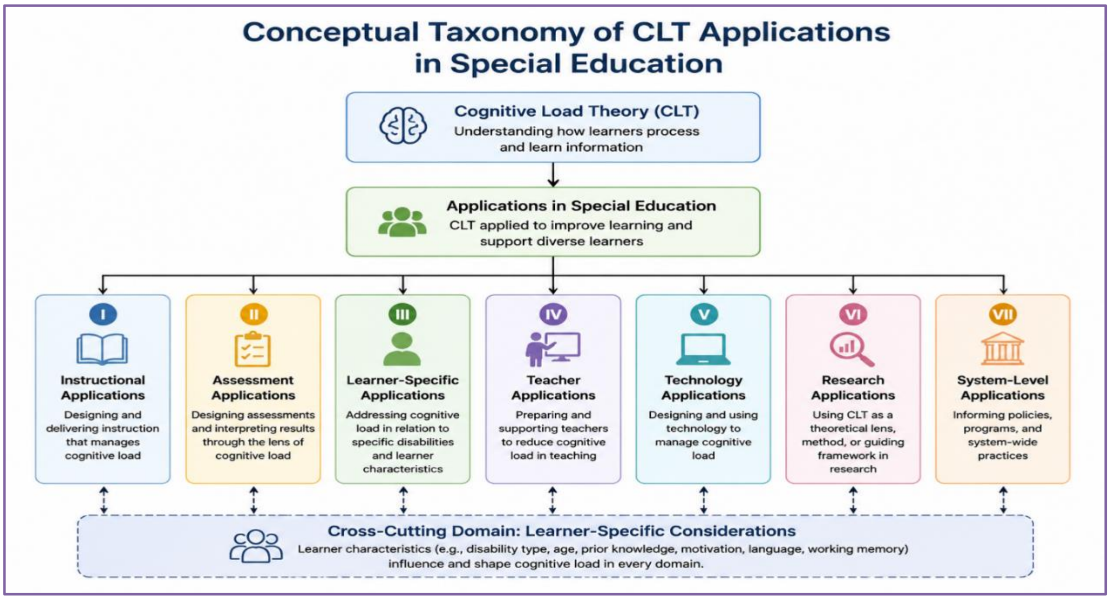
Intended beneficiaries. Finally, applications differ in who is meant to benefit most directly, the student, the teacher, the researcher, or the system. This criterion overlaps somewhat with educational purpose but adds a useful check: a teacher training study and a classroom intervention study might share an educational purpose, improving instruction, while still deserving separate treatment because they are aimed at different people in the first instance.

Figure 2. Taxonomy Development Process



Together, these six principles were used to sort the scattered applications described in section three into the seven domains presented next. None of the principles works perfectly in isolation, and a handful of studies will always sit awkwardly between categories no matter how carefully the criteria are drawn. That is a normal feature of any classification system built around real, messy research rather than a hypothetical ideal, and it is one more reason the taxonomy is presented as a working framework rather than a finished, closed system. Readers who disagree with where a particular study has been placed are, in a sense, doing exactly what a taxonomy at this stage of development should invite: testing the categories against real cases and reporting back where the fit feels forced, which is precisely the kind of feedback that will eventually make the framework more useful than a first draft, however carefully reasoned, could ever be on its own.

Figure 3. Conceptual Taxonomy



5. Proposed Conceptual Taxonomy

The taxonomy organizes CLT applications in special education into seven domains. Table 1 gives a short working definition of each before the domains are discussed in turn.

Table 1 ***Definitions of Each Taxonomy Domain***

Domain	Working definition
I. Instructional	Applications concerned with designing or delivering teaching itself
II. Assessment	Applications concerned with measuring cognitive load or related constructs
III. Learner-specific	Applications organized around a particular disability category
IV. Teacher	Applications concerned with how teachers learn, plan, and decide
V. Technology	Applications built around software, hardware, or digital tools
VI. Research	Applications concerned with generating or synthesizing evidence
VII. System-level	Applications concerned with policy, curriculum, and system structures

Domain I: Instructional Applications. This domain covers everything to do with the direct design and delivery of teaching. It includes classroom instruction shaped around load-sensitive sequencing, structured intervention programs built for a specific skill or disability, explicit instruction that breaks a task into manageable steps, curriculum adaptation that reduces unnecessary complexity without watering down the underlying content, lesson design that applies effects such as the worked example effect (Barbieri et al., 2023; Chen et al., 2023) or the modality effect (Albus & Seufert, 2023), and scaffolding that gradually removes support as a learner's schema strengthens (Zuo et al., 2023). This is the domain most special educators would recognize immediately, since it maps onto the everyday work of planning and delivering a lesson. It is also, not coincidentally, the domain with the deepest and most direct evidence base of any of the seven, since decades of CLT research in general education have already tested and refined most of the instructional principles that special education is now beginning to adapt.

Domain II: Assessment Applications. This domain covers the measurement side of CLT rather than the teaching side. It includes direct cognitive load measurement using questionnaires or physiological methods (Krieglstein et al., 2023; Kosch et al., 2023), diagnostic assessment that uses load-related indicators to help identify a learning difficulty, dynamic assessment that observes how a student responds to graduated support, progress monitoring that tracks whether an intervention is reducing unnecessary load over time, screening tools that flag students who may be experiencing chronic overload, and learning analytics that infer load indirectly from digital behavior such as time on task or error patterns. Ober et al. (2023) illustrate this domain well, having developed and validated a cognitive load measure intended specifically for general educational settings, a tool that could plausibly be adapted for special education populations with further validation work. This domain is smaller than Domain I in terms of published volume, but it is arguably the domain on which every other domain quietly depends, since none of the instructional, technological, or system-level claims made elsewhere in this taxonomy can be verified without some way of actually measuring whether cognitive load has changed.

Domain III: Learner-Specific Applications. This domain organizes research by disability category rather than by educational purpose, since so much existing work is structured this way in practice. It includes dyslexia, where load concerns center on decoding competing with comprehension (Stein, 2023); dysgraphia, where motor planning and letter formation compete with composition (Danna et al., 2023); dyscalculia, where multi-step procedures create high element interactivity (Mishra & Khan, 2022; Ahuja et al., 2021); intellectual disability, where overall processing capacity is reduced (Gupta, 2022); autism, where difficulty integrating multiple simultaneous information sources creates load spikes (Alnasser, 2023); ADHD, where sustaining and protecting load against distraction is the central challenge (Rajaprakash & Leppert, 2022); hearing impairment, where split attention across communication channels is common (Bishop & Gregory, 2022); visual impairment, where translating non-visual input into a usable mental representation carries its own cognitive cost (Muradyan, 2023); and multiple disabilities, where several of these challenges can combine and interact in ways that are still poorly understood (Nikolašević et al., 2023; Theil et al., 2023). This domain is unusual in that it cuts across all six of the others rather than sitting alongside them as an equal category, which is why section six treats it as running underneath the full chain of instructional, assessment, teacher, technology, and system-level work rather than as a separate stop along that chain.

Domain IV: Teacher Applications. This domain shifts the lens from the student to the teacher. It includes teacher education programs that embed CLT explicitly into coursework, professional development that trains practicing teachers in load-sensitive techniques, instructional decision making that helps a teacher judge, in the moment, whether a lesson is asking too much of working memory, classroom management approaches that reduce ambient distraction and extraneous load, and lesson planning tools that build CLT principles into the planning process itself rather than leaving them as background theory. Timothy et al. (2023) offer one of the few direct examples here, applying CLT within a teacher education context and treating teachers themselves as the learners whose cognitive load matters. This last point deserves emphasis, since it is easy to assume CLT only concerns student learning. Teachers, particularly those early in their careers or working outside their initial area of specialization, experience their own version of cognitive overload when planning lessons for unfamiliar disability categories, and a taxonomy that ignored this would miss a genuinely important application of the theory.

Domain V: Technology Applications. This domain covers the fast-growing intersection of CLT and educational technology. It includes AI-supported instruction that adapts pacing and content to an individual learner's estimated load (Almufareh et al., 2023), educational software built around load-sensitive design from the outset, adaptive learning platforms that adjust difficulty based on performance, assistive technology such as gesture-based interfaces for visually impaired users (Modanwal et al., 2022) or AI tools that translate visual information into more accessible formats (Wang et al., 2023), virtual reality applications including cognitive rehabilitation approaches explored for autism (Shahmoradi & Rezayi, 2022), and mobile learning applications such as Mathlete, an adaptive tool built specifically for students with dyscalculia (Dhingra et al., 2022). This domain is growing faster than any other, largely because the cost of building and testing a digital tool has dropped sharply while the appetite for personalized, adaptive instruction has grown just as sharply. That combination makes it tempting to treat any adaptive software as automatically load-sensitive, which is a mistake this taxonomy is meant to help guard against, since a genuinely load-sensitive tool needs to be evaluated using the same principles laid out in Domain I, not simply assumed to be effective because it is digital and adaptive.

Domain VI: Research Applications. This domain covers the methodological infrastructure of the field itself rather than any single intervention or tool. It includes experimental studies that test CLT-informed techniques directly, single-case experimental designs suited to the small, heterogeneous samples common in special education, quasi-experimental studies where randomization is not feasible, instrument development work aimed at building new measurement tools, validation studies that test whether those tools actually measure what they claim to measure, systematic reviews that synthesize existing evidence (Duran et al., 2022; Berssanette & de Francisco, 2022), meta-analyses that pool effect sizes across studies (Krieglstein et al., 2022), and bibliometric studies that map the shape of a research literature itself, such as Wu et al.'s (2022) bibliometric and visualization analysis of dyslexia research, an approach that could be extended just as usefully to CLT research in special education as a whole. This domain differs from the other six in an important way: it is not about applying CLT to help a learner or a teacher directly, but about building and checking the evidence base that every other domain relies on. A weak research domain, thin on replication and validation, quietly undermines the credibility of everything built on top of it, which is one reason section five of this paper's companion agenda paper argued for treating replication as a first-class priority rather than an afterthought.

Domain VII: System-Level Applications. This domain covers the broadest level of implementation, where individual classrooms and interventions connect to larger structures. It includes inclusive education policy that shapes how students with disabilities are placed and supported, school improvement initiatives that build load-sensitive practice into a school's overall approach rather than leaving it to individual teachers, government and institutional policy that funds or mandates particular practices, curriculum development at the level of an entire subject or grade band, national standards that set expectations across an education system, and teacher preparation programmes at the university level that shape how every future teacher, not just those already working in special education, understands cognitive load. This domain currently has the thinnest evidence base of all seven, since almost no published research connects CLT findings directly to policy or system-level decisions, making it one of the clearest priorities for future work. It is also, arguably, the domain where the stakes are highest, since a policy decision or national curriculum standard shapes the instructional experience of far more students than any single classroom intervention ever could, which makes the current thinness of this domain a genuine cause for concern rather than a minor gap to note in passing.

6. Relationships among Domains

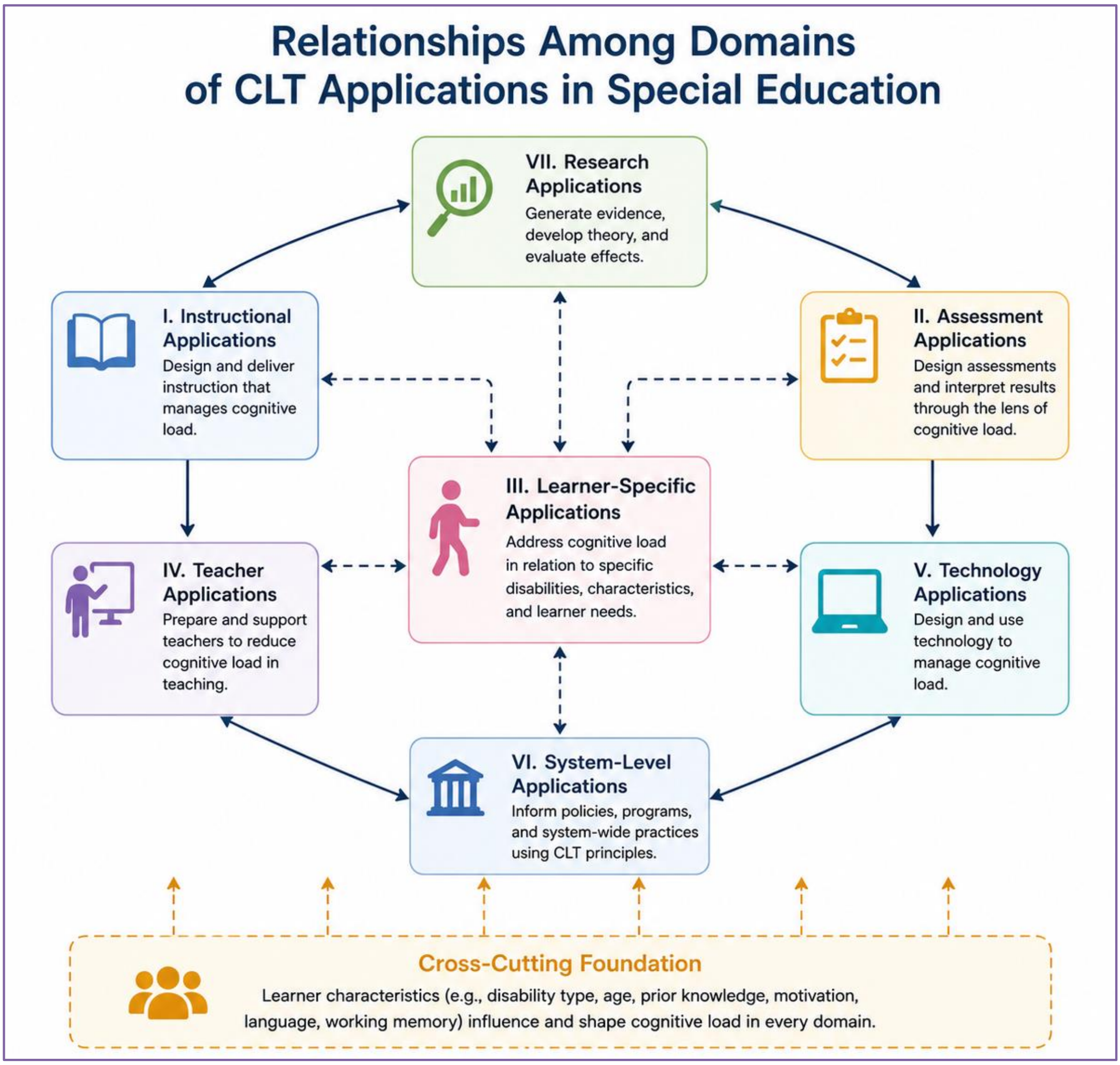
Presenting seven domains risks making the taxonomy look like seven separate boxes with no connection between them, which would badly misrepresent how this research actually works in practice. The domains are better understood as different vantage points on the same underlying phenomenon, cognitive load in the experience of learners with disabilities, rather than as isolated silos.

Consider a simple, realistic chain. A researcher might begin in Domain VI, running an experimental study on a load-reduction technique for students with dyscalculia. If the technique works, it moves into Domain I as a classroom instructional practice. Teaching that practice to educators requires Domain IV, teacher training that explains not just what to do but why it works. Knowing whether the practice is actually reducing load in a given classroom requires Domain II, some form of ongoing assessment. Scaling the practice beyond a single classroom often benefits from Domain V, technology that can deliver it consistently and adapt it to individual students. And embedding the practice as a standard part of how dyscalculia is taught, rather than an occasional individual choice, eventually requires Domain VII, policy and curriculum change. Domain III, the learner-specific lens, runs underneath this entire chain, since every step along the way is shaped by the particular cognitive profile of the disability in question.

This chain is not the only path research can take, and real projects rarely move through the domains in such a tidy, linear order. Sometimes a technology tool built in Domain V reveals an assessment gap that sends researchers back into Domain II. Sometimes a policy shift in Domain VII creates new funding for research that starts the whole sequence over again from Domain VI. What matters is not the specific order but the general principle: instruction, assessment, technology, teacher education, and policy are constantly informing and constraining one another, and a taxonomy that failed to show these connections would end up more misleading than helpful, no matter how neatly its categories were defined on their own.

A second, quieter kind of relationship runs across the domains as well: research maturity is not evenly distributed, and low maturity in one domain tends to cap how much progress is possible in the domains connected to it. System-level applications, for instance, cannot mature much further than the instructional and research domains beneath them, since a policymaker has little basis for mandating a classroom practice that has not yet been tested rigorously. Technology applications face a similar ceiling, since a genuinely load-sensitive piece of software depends on assessment tools mature enough to confirm that the software is actually reducing load rather than merely appearing to. Recognizing these dependencies matters practically, because it suggests that investing narrowly in one advanced domain, building sophisticated AI tools, for example, while neglecting the assessment and research domains underneath it, is likely to produce technology that looks impressive but rests on a shakier evidence base than its polish would suggest.

Figure 4. Relationships Among Domains



7. Illustrative Examples

Table 2 shows how a handful of illustrative studies and study types would be classified using the taxonomy, to demonstrate how the categories work in practice rather than only in the abstract.

Table 2 ***Illustrative Examples Mapped to Taxonomy Domains***

Example	Primary domain(s)
A CLT-informed handwriting intervention for dysgraphia	Instructional, Learner-specific
A questionnaire validated to measure load in classroom settings	Assessment
An AI-based reading assistant for visually impaired students	Technology, Learner-specific
A conceptual paper proposing a new CLT framework for special education	Research
A meta-analysis pooling worked example studies	Research
A teacher training programme embedding CLT into coursework	Teacher
A national curriculum revision citing cognitive load principles	System-level
An adaptive mobile application for dyscalculia	Technology, Instructional, Learner-specific

Several of these examples deliberately span more than one domain, which is expected rather than a flaw in the classification system. An adaptive mobile application for dyscalculia is simultaneously a technology application, since it depends on software design, an instructional application, since it delivers teaching content, and a learner-specific application, since it is built around one particular disability profile. A study can and often should be tagged with more than one domain, and the taxonomy is meant to support that kind of multiple tagging rather than force every study into exactly one box.

This flexibility also helps illustrate one of the clearest uses of the taxonomy in practice. A systematic reviewer trying to synthesize research on cognitive load and dyscalculia specifically could use the learner-specific domain as an anchor and then note, for each study retrieved, which other domains it also touches, instructional, technology, assessment, or research. That combination would let the reviewer see at a glance not just how many studies exist, but what kind of studies exist and, just as usefully, what kind of studies are conspicuously missing.

Table 3 extends this illustration by pairing each domain with one representative piece of published research already discussed elsewhere in this paper, giving a concrete anchor for what work in that domain currently looks like.

Table 3 ***Representative Research Within Each Domain***

Domain	Representative example
I. Instructional	Worked example effects on mathematics performance (Barbieri et al., 2023)
II. Assessment	Theory-based cognitive load questionnaire (Krieglstein et al., 2023)
III. Learner-specific	Cognitive load in dyscalculia learners (Ahuja et al., 2021)
IV. Teacher	CLT applied within teacher education (Timothy et al., 2023)
V. Technology	Adaptive assistive tool for dyscalculia (Dhingra et al., 2022)
VI. Research	Systematic review of CLT in computing education (Duran et al., 2022)
VII. System-level	No dedicated example currently identified in the reviewed literature

The empty cell in Table 3 is deliberate rather than an oversight. It reflects the genuine state of the literature reviewed for this paper: no study identified here addressed CLT at the level of policy or system-wide curriculum change for special education specifically. Leaving that cell visibly empty, rather than stretching an unrelated study to fill it, is itself one of the taxonomy's more useful functions, since it turns a vague sense that policy research is lacking into a specific, visible gap that a future researcher or funding call could target directly.

8. Benefits of the Taxonomy

A taxonomy is only worth building if it genuinely helps the people who would use it, so it is worth walking through who those people are and what the taxonomy offers each of them.

Researchers gain a shared vocabulary for describing what kind of CLT work they are doing, which makes it easier to find related studies, position new work relative to what already exists, and spot underexplored domains, such as system-level applications, that might otherwise be overlooked simply because nobody had a name for that gap.

Teachers gain a clearer sense of where formal CLT research actually touches their daily practice. A teacher looking specifically for classroom-ready guidance can go straight to the instructional domain rather than wading through assessment instrument validation studies that were never meant for classroom use in the first place.

Journal editors gain a framework for organizing special issues, soliciting submissions in underrepresented domains, and assigning reviewers whose expertise actually matches the type of application a submission represents, rather than treating all CLT-and-special-education submissions as interchangeable.

Funding agencies gain a way to see, at a glance, where research investment has concentrated and where it has not. If system-level applications remain nearly empty years after this taxonomy is proposed, that gap becomes a visible, arguable case for targeted funding calls rather than an invisible absence nobody notices.

Universities gain a structure for building CLT content into teacher preparation and special education degree programs in a way that covers the full range of applications, rather than teaching only the instructional domain and leaving assessment, technology, and system-level content out simply because no one organized the field clearly enough to notice the omission.

Students benefit indirectly but importantly, since a more organized research field is more likely to produce coordinated, well-tested practices that actually reach classrooms, rather than isolated findings that stay trapped in academic journals.

Systematic reviewers gain perhaps the most direct and immediate benefit, since a shared taxonomy makes it far easier to define the scope of a review, search consistently across studies, and report findings in a way that later reviewers can build on rather than starting from scratch each time.

Policy makers gain a clearer sense of which domains have enough evidence to justify a policy recommendation and which remain too thin to support one, reducing the risk of policy running ahead of, or lagging badly behind, the actual state of the evidence.

What ties these eight groups together is that each of them is currently working with an incomplete picture of the field, not because the relevant information does not exist, but because it exists scattered across disconnected literatures with no shared index. A taxonomy does not create new knowledge on its own. What it does is make existing knowledge findable, comparable, and buildable-upon, which is a more modest claim than it might first sound but also, in a field growing as quickly as this one, a genuinely valuable one.

9. Future Refinement

The taxonomy presented here is an initial framework, built from one researcher's reading of the current literature, and it would be a mistake to treat it as a finished or final classification system. Several steps would strengthen it considerably.

International validation. The literature underlying this taxonomy skews heavily toward research from North America, Europe, and parts of East Asia. Researchers working in South Asia, the Middle East, Africa, and Latin America, often in very different educational systems and resource conditions, need to test whether these seven domains actually capture their own work, or whether additional categories are needed to reflect practices and constraints that look different outside well-resourced systems.

Delphi studies. A structured Delphi process, in which a panel of special education and CLT researchers respond anonymously to successive rounds of questions about the taxonomy, revising their views as they see the group's aggregated responses, would help identify which domains and definitions command genuine consensus and which remain contested.

Expert consensus. Beyond a formal Delphi process, simply convening working groups of experienced special educators, cognitive psychologists, and technology developers to critique the taxonomy directly would surface blind spots that a single author, however careful, is likely to miss.

Cross-cultural adaptation. Some domains, teacher education and system-level applications in particular, are likely to look quite different depending on how a country's education system is structured, funded, and governed. A taxonomy built primarily from literature produced in centralized, well-resourced systems may need real adaptation, not just translation, to serve researchers working in more decentralized or resource-constrained contexts, including many public sector special education systems where cognitive load research is only beginning to take root.

Periodic revision. Finally, this taxonomy should not be treated as permanent. As CLT itself continues to evolve, and as new applications emerge that do not fit cleanly into any of the seven domains proposed here, the taxonomy will need periodic revision, ideally on a fixed schedule such as every five years, so that it keeps pace with the field it is meant to organize rather than becoming an outdated snapshot of where the field stood at one particular moment.

Table 4 offers a brief, speculative look at where each domain might plausibly head over the coming years, offered here as a starting point for discussion rather than a firm prediction.

Table 4 ***Potential Future Developments for Each Domain***

Domain	**Plausible future direction**
I. Instructional	Disability-specific instructional guidelines validated through replication
II. Assessment	Load measures validated specifically for nonverbal or minimally verbal learners
III. Learner-specific	Research extending beyond single-disability studies into co-occurring conditions
IV. Teacher	Standardized CLT modules within special education certification programmes

V. Technology	AI systems that adjust in real time based on validated load indicators
VI. Research	Coordinated replication networks across countries and research groups
VII. System-level	First generation of policy pilots explicitly citing CLT evidence

None of these directions is guaranteed, and some may turn out to be wrong once more research accumulates. That uncertainty is not a weakness of the table. A taxonomy that tries to predict its own field's future with total confidence would be overreaching, and the honest purpose of Table 4 is simply to give researchers and funders a starting point for imagining what progress in each domain could plausibly look like, not a roadmap they are obligated to follow.

10. Conclusion

Special education research on Cognitive Load Theory has grown quickly, and that growth is worth celebrating rather than treating as a problem. But growth without organization eventually becomes its own kind of obstacle, making it harder for researchers to find each other's work, harder for teachers to locate what actually applies to their classrooms, and harder for the field as a whole to see where its evidence is strong and where it is still thin. The taxonomy proposed in this paper, organized around instructional, assessment, learner-specific, teacher, technology, research, and system-level applications, is an attempt to give this growing body of work a shared structure before its scattered nature becomes any harder to untangle than it already is.

A shared taxonomy provides a common language for organizing and advancing CLT research in special education. It should not constrain innovation but support clearer communication, comparison, and cumulative knowledge building. None of the seven domains proposed here should be read as a boundary that future researchers must respect. Some domains will likely split further as research accumulates within them. Others may merge, or turn out to need entirely different names once more international and cross-cultural input has been gathered. What should last, even as the specific categories evolve, is the underlying habit this paper is trying to encourage: treating CLT applications in special education as a connected field worth mapping deliberately, rather than as a growing pile of individually interesting studies that happen to share a citation to Sweller.

This paper and the companion agenda paper it builds on are best read together rather than separately. The agenda paper makes the case for why CLT deserves a central place in special education research and lays out a phased path for building the evidence base the field currently lacks. This paper takes that same growing body of work and asks a narrower but complementary question: once the evidence starts accumulating, how should it be organized so that researchers, teachers, and policymakers can actually find and use it. Neither question is more important than the other. A field can generate excellent individual studies and still fail to become a coherent area of practice if nobody builds the shared structure that lets those studies add up to something larger. The taxonomy proposed here is an early attempt at building that structure, offered in the hope that other researchers will test it, argue with it, and improve it, rather than treat it as a finished answer to a question the field has really only just begun to ask.

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