

Educational Competitive Intelligence Capability in Early Childhood Education: Enhancing Children's Picture Book Reading Comprehension

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Abstract: Purpose: This review develops Educational Competitive Intelligence Capability as an organizational capacity for improving picture-book reading comprehension in early childhood education. It explains how schools can define intelligence needs, scan relevant environments, acquire and interpret evidence, disseminate insight, use it in teaching, and learn from outcomes. Methodology/approach: A structured integrative review synthesized 34 peer-reviewed sources published from 2020 to 2025 across competitive intelligence, educator data use, shared reading, narrative comprehension, and digital picture books. Evidence was coded against eight intelligence-cycle functions and comprehension-related instructional decisions. Heterogeneous designs were synthesized thematically rather than pooled statistically. Originality/Relevance: The article keeps competitive intelligence at the organizational level. Children are not treated as competitors or intelligence agents. Their responses become ethically governed evidence for teacher and school decisions. Key findings: Stronger decision processes combine purposeful scanning with multimodal evidence, contextual interpretation, collaborative dissemination, adaptive teaching, and explicit feedback. Information volume alone does not constitute capability. Theoretical/methodological contributions: The review proposes an eight-domain Educational Competitive Intelligence Capability cycle and a 24-item measurement specification for future validation. It connects intelligence governance with book selection, dialogic questioning, multilingual support, inference, retelling, and comprehension monitoring while defining clear empirical boundaries for subsequent field research worldwide.

Keywords: competitive intelligence; early childhood education; educational intelligence; picture books; reading comprehension; intelligence cycle.

1. Introduction

Reading in picture books is an information-rich activity in early childhood programs. Shows children's observation, comprehension, inferences, and retelling. However, often these signals stay with one activity or teacher. The real issue is not a lack of information, but a lack of a systematic process to move that information into timely instructional decisions. Competitive intelligence (CI) provides such a process. Recent studies on CI focus on the intelligence as a decision-making tool rather than reporting. The utility of its value lies in the fact that it is created when an organisation decides to define an intelligence need, then scans relevant environments, acquires information, evaluates and interprets it, disseminates insight to responsible actors, uses insight in decisions, and learns from the consequences of these decisions (Cavallo et al., 2021; Madureira et al., 2021, 2023). Coordinating environmental scanning is important as well, since signals of interest are scattered among various people, units and open sources rather than concentrated in one location (Lutz & Bodendorf, 2020; Robinson et al., 2021). With mature systems, it is as important to have information quality, accountability, and feedback as it is to have a lot of information. There is a coordination challenge in early childhood settings. Teachers, parents, leaders and specialists

have varying realities and evidence about children's books, language, comprehension, resources, and supports and needs. They are only really useful when they are linked to a clear decision; otherwise, observations build up and become intelligence. This distinction will be relevant for the purposes of the present article. The term Educational Competitive Intelligence Capability (ECIC) is used here to refer to the capacity of an early childhood setting to make decisions about book reading comprehension that are both actionable and reviewable based on ethically gathered internal and external signals. It is NOT a word for the child's thinking. Children are not brought into the world to be competitors, analysts or intelligence agents. They speak, they look, they retell, they ask questions, they draw and sequence and their learning can be evidenced through their talk, their look, their retelling, their questions, their drawing, their sequencing, and their other responses. It is the teaching and learning that is intelligent, not the evidence itself. This organisational interpretation is relevant to the journal's CI focus. Recent studies investigated the topics of the maturity of CI, information behavior, foresight, innovation, and professional-generated content (Alrashedi, 2023; Calof, 2025; De las Heras-Rosas & Herrera, 2021; Maungwa & Laughton, 2023; Oraee, 2023; Qian et al., 2024). In addition, Bao (2020) demonstrates that CI can be assessed by observable information practices. Business items can't be duplicated in Preschool, but ECIC also needs routines to be observed, not a metaphorical use of intelligence.

Decision domain of picture-book comprehension: Evidence pathway is visible. Responsive shared reading and language environments influence children's expressions (Finders et al., 2023; Grøver et al., 2020, 2022). Narrative reasoning is supported by wordless books (Grolig et al., 2020), whereas vocabulary, grammar, metacognitive knowledge and task orientation are essential for comprehension and retelling skills (Khan et al., 2021; Lepola et al., 2020). Digital design can be distracting or attentional (Bus & Anstadt, 2021; Egert et al., 2022; Son & Butcher, 2024). There is more evidence than just one classroom format for parent-child reading and storytelling (Lorio et al., 2022; Maureen et al., 2020). In most situations, these results do not appear as an intelligence cycle. The second gap is the organizational use. It is not enough for educators to have access to assessment data; they need skills, interpretation routines and organizational support (Beatson et al., 2025; Blumenthal et al., 2021; Børte et al., 2023; Filderman et al., 2022). It's the same assessment from another discipline: relevance, analysis, dissemination, utilization and learning should be linked. This intersection allows ECIC to be measured without it being considered CI data. The review is guided by four questions. The first question of this module (RQ1) seeks to define ECIC based on the functions of the intelligence cycle. RQ2 examines how they structure evidence related to understanding a picture book. RQ3 explores factors that support or impede the adoption of evidence into decisions about instruction. RQ4 seeks to answer how to measure ECIC, if it is not a validated construct that is being presented as a scale. No participant dataset or causal effect is claimed; the outputs are an eight-domain capability cycle, a measurement specification based on the review, and an agenda for validation.

2. Theoretical Framework

The framework starts with the concept of information, intelligence and educational outcome. Information is a signal: A child's response, a family observation, a new picture book, a change in curriculum, research finding. An interpreted statement that is associated with a decision. An outcome is a change that occurs as a result of a decision, like a better retelling, better inference, or using the vocabulary more independently. ECIC is related to the organizational procedures that link these three levels.

2.1. Competitive Intelligence as a Capability

Recent CI research treats capability as modular and context-sensitive. Madureira et al. (2021, 2023) link CI to connected processes, roles, methods, technology, and organizational learning. Cavallo et al. (2021) emphasize conversion of information into decisions, while Maungwa and Laughton (2023) show that CI draws on diverse theoretical bases. Moving CI into education therefore requires explicit construct boundaries. ECIC is organized around eight functions: intelligence planning, environmental scanning, evidence acquisition, analysis and interpretation, dissemination, utilization, feedback and learning, and intelligence governance. Together they define need, gather and interpret evidence, move insight to responsible actors, connect it to teaching, review outcomes, and govern access and accountability. Figure 1 presents the functions as a closed cycle because feedback changes the next intelligence need.

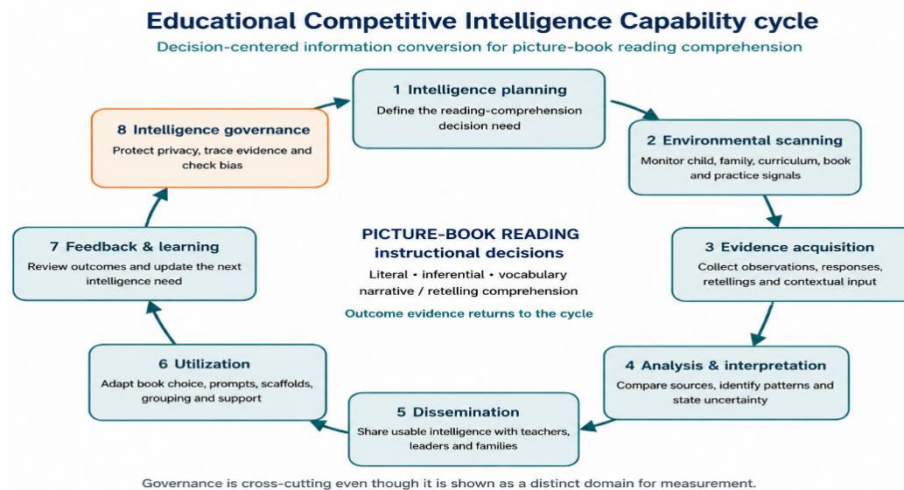


Figure 1. Educational Competitive Intelligence Capability cycle for picture-book reading comprehension. Source: Author-developed synthesis based on Cavallo et al. (2021), Madureira et al. (2021, 2023), Robinson et al. (2021), and the reviewed early-literacy evidence.

2.2. Picture-Book Comprehension as a Decision Domain

Picture-book comprehension involves event tracking, vocabulary, inference and narrative organization. The demands vary by age, language experience, book design, and adult intervention. Narrative studies separate out surface language from macrostructure; a single answer can't be seen as proof of understanding alone (Khan et al. 2021; MacLeod & Pesco 2023). Narrative picture-book comprehension is also predicted by vocabulary and metacognitive factors over development (Lepola et al., 2020).

In particular, the evidence comes in a variety of formats which makes it very helpful for ECIC. A teacher might hear an incorrect explanation during a reading, see that a few children do not understand a pronoun, observe that a bilingual child is able to comprehend the sequence but struggles to put it into words in the language of instruction, or notice that the animation distracts from the plot. None of these observations is intelligence, per se. Each becomes intelligence when it is interpreted as a decision need and then associated with a response that can be later reviewed. Shared-reading evidence can lead to varying decisions, based on context. Children's expressions are shaped by adult follow-up, pacing, explanation, and responsiveness (Grøver et al., 2022). Parent-child interaction within a structured conversation is one way that helps deepen book interaction and the oral practice of narrative telling (Reese et al., 2023; Riordan et al., 2022). The integration of digital features can aid comprehension as long as they are relevant to the story, but can distract as well if they are not (Bus & Anstadt, 2021; Egert et al., 2022; Son & Butcher, 2024). It should be integrated into ECIC pedagogical, linguistic, technological and family signals.

2.3. From Classroom Evidence to Organizational Intelligence

The CI contribution is what makes it different at the organizational level. A teacher has the freedom to plan local adjustments to instruction while retaining the setting's ECIC. Organizational capability needs to have repeatable practices: evidence is captured, accountability is set, insights are shared amongst appropriate people, and this insight feeds back into the evidence system. Thus, ECIC is about the ability to use information, rather than information itself. This boundary is backed by teacher data-use research. The effectiveness of the decision-making process relies on the competence of the educator, the opportunity of the organization, the technology used, and clarity of the decision-making process (Beatson et al., 2025; Børte et al., 2023). While data literacy training can enhance data literacy without ensuring institutional use (Filderman et al., 2022), educator perspectives can also be context dependent (Blumenthal et al., 2021). The individual competence is in ECIC, but ECIC is not the same as individual competence. The model also establishes an ethical limit. ECIC must not be a means of child surveillance or ranking. Collection should be commensurate with the decision; access should be reserved and temporary performance should not be a permanent label. Governance is thus a measured domain. If a setting does not explain why, it is collecting evidence, who might have access to it, and how decisions are reviewed, then it should not be called a setting with strong ECIC. Rationale for P2–P5 Feature Level Selection. The proposed framework adopts multi-level features from P2 to P5 because UAV imagery contains objects with substantial scale variation.

The higher-resolution P2 feature level preserves fine spatial details required for small and densely distributed targets, whereas P3 and P4 provide intermediate semantic representations for objects with moderate sizes. The P5 level contributes stronger contextual information for larger objects and complex background structures. Combining these feature levels enables the AMFF module to balance spatial precision and semantic discrimination across different UAV detection scenarios. Dataset protocol. The VisDrone2019-DET dataset was divided into training, validation, and testing subsets. The training subset was used for model optimization, the validation subset was used for monitoring and configuration selection, and the test subset was reserved for final evaluation.

3. Method

Implementation Details. The proposed framework was implemented using the PyTorch deep learning framework. All experiments followed a consistent training configuration. Input images were resized to 640×640 pixels. The model was optimized using SGD with an initial learning rate of 0.01, momentum of 0.937, and weight decay of 0.0005. Training was performed for 300 epochs with a batch size of 16. Data augmentation included mosaic augmentation, random scaling, flipping, and color variation.

Table 1. Implementation settings

Parameter	Value
Framework	PyTorch
Input size	640×640
Optimizer	SGD
Learning rate	0.01
Momentum	0.937
Weight decay	0.0005
Batch size	16
Epochs	300
Augmentation	Mosaic, scaling, flipping, color variation

A structured integrative review was used because CI capability and early-childhood picture-book comprehension do not share a common outcome metric. The aim was not a pooled effect. It was to identify defensible process relationships, preserve construct boundaries, and translate them into a measurement architecture for field validation.

3.1. Review Design and Bounded Evidence Corpus

A bounded corpus of 34 peer-reviewed sources from January 2020 to December 2025 is used for the review. The corpus is made up of research on competitive-intelligence processes and capabilities, research on educator data use, and early childhood evidence of shared reading, narrative comprehension, picture books, and digital story formats. It does not constitute a comprehensive list of literature or literature on how information can be translated into decisions; rather, it facilitates an integrative synthesis of these.

The evidence related to the educational context involved preschool, kindergarten or the closely associated early childhood contexts and included evidence informing comprehension, evidence of use of adult mediation, narrative/inferential processing, book design, educator evidence use, and/or ECIC function. No studies conducted in other sectors of CI were used as direct evidence of children, but were used only to define the intelligence processes and measurement logic.

Dataset protocol. The VisDrone2019-DET dataset was evaluated following a standard object detection procedure. The training subset was used for model optimization, the validation subset was used for monitoring training behaviour and selecting model configurations, and the testing subset was reserved for final performance evaluation. All compared models followed the same protocol to ensure fair comparison.

3.2. Source Identification, Eligibility, and Reporting Boundary

The source-identification logic which identifies the corpus is reported in the review for transparency, but not as a claim to an exhaustive search of a database. The early childhood, picture books, shared reading, comprehension, narrative, retelling, inference, vocabulary, digital storybooks, and adult-child discourse aspects of early childhood were grouped together as topic families. The CI concept families integrated the elements of competitive intelligence with planning, environmental scanning, acquisition,

analysis, dissemination, utilization, maturity, governance, decision making, feedback and organizational learning. To ensure conceptual continuity, citation links were inserted between closely related papers.

An eligibility criterion required the paper to be peer-reviewed and published between 2020 and 2025, and to include bibliographic metadata, as well as a clear contribution to an ECIC function or to a picture-book comprehension decision. Sources that fell outside the date range, did not have a defensible association to the capability cycle, and did not support the assigned source were excluded. There were no concomitant database-hit, duplicate, exclusion, and inter-rater records to be audited and not reconstructed. PRISMA 2020 is therefore not intended to signify full compliance with the systematic-review approach (Page et al., 2021). That boundary is made explicit in figure 2.

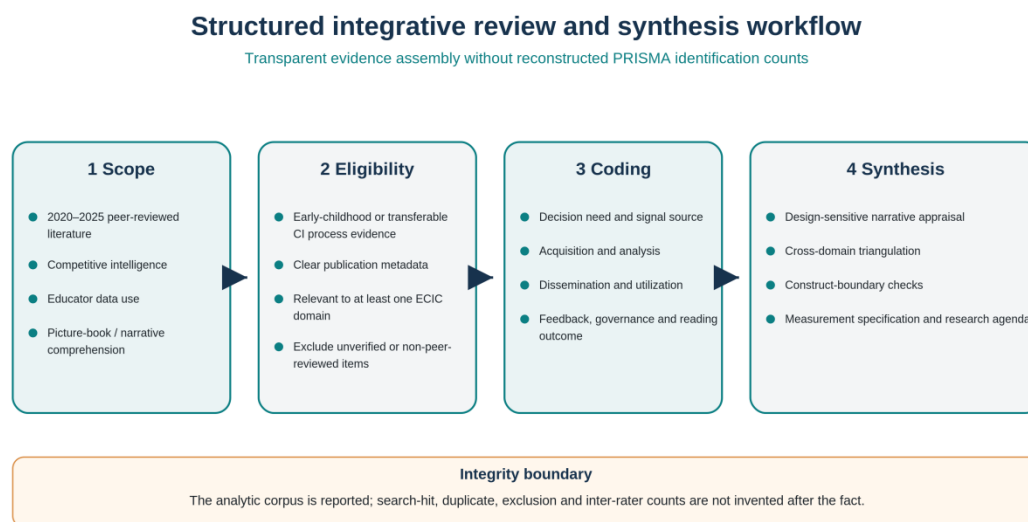


Figure 2. Structured integrative review and synthesis workflow. Source: Author-developed review workflow. PRISMA 2020 is cited only as a reporting reference; unavailable identification, exclusion, and inter-rater counts are not reconstructed (Page et al., 2021).

3.3. Ci-Relevance Coding

These sources were identified with regard to the eight functions of ECIC and with respect to the educational decision that they could be considered as a source for. Codes related to book selection, vocabulary and inference support, questioning, retelling, multilingual access, digital features, family participation, and follow-up assessment were included. The following are recognized by CI codes: Intelligence need, signal source, acquisition, analysis, dissemination, utilization, feedback, governance, and maturity. A source was only kept in the synthesis when it was possible to say explicitly that this was the source. The coding question was a working question: What information is generated, who needs it, what decision is to be made that will change, and how will it change back to the cycle?

Coding also captured source role and transfer boundary, and the types of inferences that each design could make. This was needed because processes of capability and measurement logic were defined using CI studies outside of education, while comprehension evidence and instructional decisions were identified using early-childhood studies. The two streams of evidence were not considered to be interchangeable, but were linked at the organizational decision level.

3.4. Design-Sensitive Quality Appraisal

A separate appraisal step was used to prevent domain transfer from weakening the CI construct. The framework did not rank studies with an artificial total score. Instead, it tested whether each source was bibliographically traceable, relevant to an ECIC function, interpreted within design limits, and used only for the kind of inference it could support. Table 1 summarizes these rules.

Table 1. CI-relevance and design-sensitive appraisal framework

Appraisal criterion	Review rule	Why it matters for CI
Bibliographic integrity	Use 2020-2025 peer-reviewed sources with identifiable authors, outlet, year, and DOI where registered.	Reduces unsupported source use and keeps the evidence trail auditable.

Construct relevance	A source must inform at least one ECIC function or a picture-book comprehension decision.	Keeps competitive intelligence central rather than decorative.
Design appropriateness	Interpret interventions, longitudinal studies, reviews, and CI studies only within the limits of their designs.	Prevents causal or developmental overreach.
Evidence traceability	Map source -> signal/evidence -> ECIC function -> decision use -> limitation.	Shows how information becomes decision-relevant intelligence.
Transfer boundary	Non-education CI studies define process or measurement logic only; they do not establish effects on children.	Protects construct validity when CI is transferred to education.
Measurement readiness	Treat the 24 ECIC items as candidate indicators until content and structural validity are demonstrated.	Prevents an unvalidated item pool from being reported as an established scale.

Note. The appraisal framework is qualitative and design-sensitive. It does not assign invented study scores or treat business-sector CI evidence as direct evidence of child outcomes.

3.5. Synthesis and Measurement-Development Logic

The synthesis was carried out in three passes. The evidence was first identified with the eight intelligence functions, then matched with specific decisions in the picture books and then converted into candidate measurement domains. The item list that results from the ECIC-Cycle is not a validated scale but a specification for it to be validated; the reliability coefficient, factor loading, norm, cutoff score, or population score are not reported.

The validation of the measurement model is suggested for future studies prior to using an overall ECIC score. Content validity is a two-step process that involves early-childhood and CI expertise, followed by a factorial or composite evaluation in a sufficiently large field sample. Criterion validity should be related to outcomes of a child and to traceable decision quality related to ECIC. Because the abilities of teachers and settings are operationalized as the dependent variable, and the comprehension is operationalized in the children, multilevel and longitudinal designs are required. This pathway is summarised in Figure 3.

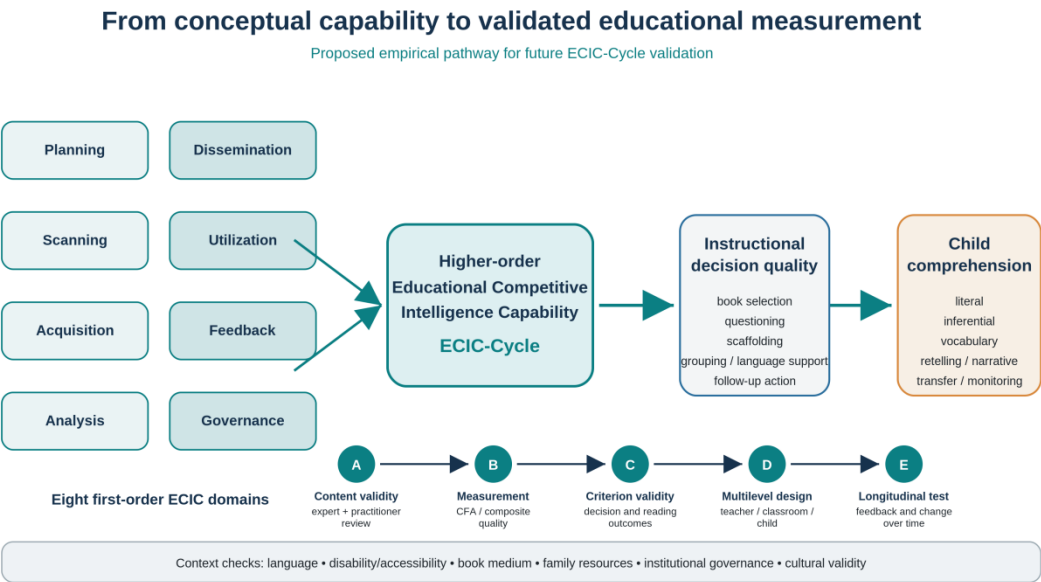


Figure 3. Proposed pathway from ECIC conceptualization to field validation and child-level comprehension outcomes. Source: Author-developed synthesis based on CI capability and educator data-use evidence (Beatson et al., 2025; Madureira et al., 2023).

4. Results and Discussions

The synthesis supports a full organizational intelligence cycle rather than a three-step classroom metaphor. Across both literatures, evidence becomes useful when a decision need determines what is noticed, how it is interpreted, who receives it, what action follows, and how the result is reviewed. The educational literature supplies comprehension evidence; CI supplies the organizational process architecture. Table 2 summarizes the construct map.

Table 2. ECIC construct map for picture-book reading decisions

ECIC domain	Core organizational question	Picture-book evidence / decision examples
Intelligence planning	What decision must be made, by whom, and by when?	Define whether the decision concerns vocabulary, inference, retelling, book difficulty, digital design, language access, or follow-up.
Environmental scanning	Which internal and external signals may change the decision?	Curriculum, available books, child interests, family language/context, accessibility, research, peer practice.
Evidence acquisition	What evidence is necessary and proportionate?	Observation, responses, retelling, sequencing, drawing/gesture, family input, prior records.
Analysis & interpretation	What does the evidence mean and how uncertain is the interpretation?	Compare sources; separate comprehension from expressive-language limits; identify patterns, alternatives, gaps.
Dissemination	Who needs the intelligence and in what form?	Team summary, family conversation, specialist input, leader note; include evidence and uncertainty.
Utilization	What instructional action follows?	Select/adapt books, questions, scaffolds, grouping, language support, or digital features.
Feedback & learning	Did the decision produce the expected change?	Repeat observation, compare retelling/inference, review implementation, retain lessons.
Intelligence governance	Is the evidence use ethical, traceable and proportionate?	Data minimization, privacy, access control, bias checks, non-deficit language, accountability.

Note. ECIC = Educational Competitive Intelligence Capability. The domains adapt contemporary competitive-intelligence process logic to early childhood organizational decisions (Cavallo et al., 2021; Madureira et al., 2021, 2023; Robinson et al., 2021); they are not child-level constructs.

4.1. Intelligence Planning and Environmental Scanning

The first barrier to indiscriminate data collection is planning. A picture-book intelligence need needs to be expressed as a decision, such as: Will the vocabulary need to change? Will the causal inference need to change? Will there be a digital feature added? Will more than one language be included? The evidence for supporting different questions will vary. Note that the evidence boundary is established as part of the planning process prior to evidence collection.

Environmental scanning is not limited to the child but also involves curriculum expectations, books, research, online tools, family and language context, accessibility and professional practice. The CI research indicates that the scanning of fragments with signals containing in different units (Robinson et al., 2021). However, ECIC gathers teacher, family, specialist, leadership and external evidence together around the decision need.

The impact of scanning is demonstrated with picture book research. In visual narratives, attention to the relationships between the images (Cohn, 2020) provides visual evidence for dialogic reasoning, as in the Wordless-Book intervention (Grolig et al., 2020). In a digital environment, the inclusion of animation, hotspots, narration and sound adds to or detracts from meaning (Bus & Anstadt, 2021; Egert et al., 2022; Son & Butcher, 2024). Of course, for ECIC, these results are signals from outside which form a basis for book and technology selection.

4.2. Evidence Acquisition and Analysis

Acquisition is about getting sufficient relevant evidence to decrease uncertainty. Some sources are observation, answers, retellings, sequencing, drawing, gesture, home-language responses, family reports and structured assessment. It's not about the maximum data. There is a burden and privacy risk with over-collection, and it does not necessarily improve decision-making.

Multimodal evidence may be necessary to understand the contents of a picture book, since expression frequently hides comprehension. The story may be preserved and lexical detail unevenly distributed between languages (MacLeod & Pesco, 2023) for bilingual children. Vocabulary and grammar facilitate storytelling skills, but do not deplete comprehension (Khan et al., 2021). Therefore, it would be useful to differentiate a comprehension problem from a response-format problem in ECIC analysis.

Analysis is when evidence goes to intelligence. The task is to compare and evaluate sources, to assess the credibility of sources, to recognize patterns, to test alternatives, and to state uncertainty. In early childhood, this typically is not statistical; it's collaborative. Research on CI supports the distinction between interpretation as mere information and as information that is relevant to and interpretable for decision making (Cavallo et al., 2021), and research on professional-generated content shows that quantity does not replace relevance or interpretability (Qian et al., 2024).

A common mistake is to view a score as a reason. Frequently a low comprehension score may indicate lack of vocabulary, attentiveness, lack of knowledge of unfamiliar words, lack of narrative structure, incorrect answer language, or poor book design. When an assessment of these alternatives is carried out through ECIC analysis, they remain visible which is not the case if they are reduced to a measurement.

4.3. Dissemination and Intelligence Utilization

Often dissemination is the missing link. The collection of evidence - whether in a notebook, on a platform or in one teacher's memory - can be good but not result in change of practice. As dissemination is a capability, CI identifies a need for insight to be delivered to the responsible actor at the right time, and in the right format (Madureira et al., 2021; Maungwa & Laughton, 2023). For young children, this could be a short-term note or a family conversation, specialist input, or leadership decision.

Dissemination should leave uncertainty. A valuable intelligence statement includes the evidence, boundary of the claim, and instructional target. This also allows for disagreements: unfamiliar vocabulary, background knowledge, or the prompt itself may explain the difficulty observed.

Wherever intelligence changes practice, it is on the level of utilization. Various forms of responsive teacher talk, dialogic work with wordless books, structured family conversation, and blends of story reading and playful activity can promote language or narrative learning (Chlapana & Koniou, 2025; Grøver et al., 2020, 2022; Grolig et al., 2020; Reese et al., 2023; Riordan et al., 2022). ECIC does not specify any one approach but outlines the rationale for choosing an action that is aligned to a documented need.

Utilization can be reviewed by a simple decision record that documents the following: What changed, why, who changed it, who was impacted, and what evidence will show improvement. The use of a new book, a new app, or a new questioning routine does not constitute an act of intelligence. A new book, app, or questioning routine is not used to show intelligence until a need is identified and subsequently reviewed.

4.4. Feedback, Learning, and Intelligence Governance

The cycle is closed with feedback which asks if the expected pattern changed, and if the initial interpretation was satisfactory. With vocabulary supports, continuing distraction from a digital feature, and an enhanced performance with a multilingual response option respectively, each changes the next intelligence need.

Organizational learning relies on lessons being captured in an agreed observed format, book notes, scaffold records, short decision logs, and set review points. Routines become repeatable and learning from use is the evidence for the CI maturity (Madureira et al., 2023). Foresight also connects the dots between what is happening now and what may be changing in the future (Calof, 2025).

The cycle is limited by governance. Child and family evidence are sensitive and should be collected only when warranted, accessed with great care, interpreted with great care, and labels of deficits should be avoided. Competitive intelligence in this context is not about competition among children but rather the

ability of an organisation to process information.

4.5. Evidence Synthesis for Picture-Book Decisions

Table 3 links representative studies to ECIC decisions. A single study can inform scanning, acquisition, utilization, or feedback, but only within the limits of its design. The organizational task is to preserve those links rather than copy an intervention without considering local needs.

Table 3. Representative evidence mapped to ECIC decisions

Evidence example	What the study contributes	ECIC decision use
Grøver et al. (2020, 2022)	Shared reading and teacher talk support language development; interaction quality matters.	Scan discourse patterns; observe reasoning; adapt talk; review outcomes.
Grolig et al. (2020)	Dialogic wordless-book work supports narrative learning.	Use visual evidence/retelling to interpret narrative organization and select support.
Lepola et al. (2020)	Vocabulary, metacognition and task orientation predict narrative comprehension.	Avoid single-cause claims; analyze language and regulation with comprehension.
Khan et al. (2021)	Vocabulary and grammar contribute to narrative ability.	Separate lexical/grammatical barriers from broader comprehension needs.
MacLeod & Pesco (2023)	Bilingual children may retain narrative strengths despite surface-language differences.	Allow multilingual/alternative responses before classifying difficulty.
Bus & Anstadt (2021); Egert et al. (2022)	Digital picture-book value depends on design and context.	Audit features for narrative relevance and accessibility.
Son & Butcher (2024)	Animation effects vary with story alignment.	Use evidence to retain or remove attention-directing features.
Reese et al. (2023); Riordan et al. (2022)	Structured parent book talk can strengthen interaction and oral narrative.	Include family knowledge in dissemination, utilization, and feedback.

Note. The table is illustrative rather than exhaustive. Studies are used only for the type of evidence their designs support.

Three cross-cutting patterns recur. Adult mediation changes the informational value of a picture book; language accessibility determines whether comprehension can be observed; and digital features are conditional supports rather than automatic improvements. ECIC quality therefore depends on alignment among evidence source, interpretation, instructional response, and outcome measure.

4.6. Proposed Ecic-Cycle Measurement Specification

A central purpose is to move CI from a descriptive label to an operational organizational construct. Table 4 specifies 24 candidate indicators across eight ECIC domains for teachers, coordinators, and early-childhood leaders involved in picture-book decisions. The indicators measure observable intelligence routines - not children - and use a proposed seven-point agreement format for future field testing. They do not constitute empirical measurement in the present review and do not establish scale validity.

Table 4. Proposed 24-item ECIC-Cycle measurement specification

Domain / codes	Proposed item stems for future field validation
Planning (P1–P3)	P1 We define the reading-comprehension decision before collecting evidence. P2 We identify who will use the intelligence and when. P3 We prioritize questions so evidence collection remains focused.
Scanning (S1–S3)	S1 We monitor curriculum, research and guidance relevant to picture-book comprehension. S2 We monitor children's interests, language backgrounds and recurring comprehension needs. S3 We compare books, digital resources and peer practices before major decisions.
Acquisition	A1 We systematically gather relevant evidence from discussion, retelling or

(A1–A3)	other responses.
	A2 We obtain family/context information when needed to interpret performance.
	A3 We record the source and conditions of important comprehension evidence.
Analysis (AN1–AN3)	AN1 We compare more than one source before drawing a comprehension conclusion.
	AN2 We consider alternatives such as vocabulary, response language or task design.
	AN3 We state uncertainty when evidence does not support a firm interpretation.
Dissemination (D1–D3)	D1 Relevant reading intelligence reaches decision makers in time for planning.
	D2 Intelligence summaries distinguish evidence from interpretation.
	D3 Teachers can challenge interpretations before action.
Utilization (U1–U3)	U1 We use intelligence to select/adapt books for identified comprehension needs.
	U2 We use intelligence to adjust questions, scaffolds, grouping or language support.
	U3 Important intelligence is linked to follow-up action and a responsible person.
Feedback (F1–F3)	F1 We review whether intelligence-informed decisions produced the expected change.
	F2 We update interpretations when follow-up evidence contradicts them.
	F3 Lessons from earlier decisions are retained for later planning.
Governance (G1–G3)	G1 We collect only child/family information necessary for the decision.
	G2 Sensitive reading evidence is limited to legitimate educational roles.
	G3 We check intelligence practices for bias, deficit labels and unsupported child comparison.

Note. Proposed response format for future validation: 1 = strongly disagree to 7 = strongly agree. These items are review-derived candidates, not a validated scale. Their structure is informed by direct CI measurement and maturity work (Bao, 2020; Madureira et al., 2023). Dimension and higher-order scoring should be established empirically before substantive use.

The proposed score structure is conservative. Each domain should first be evaluated separately. An overall ECIC-Cycle score is defensible only if testing supports a higher-order or composite structure. Arbitrary capability cutoffs should not be created. Bao (2020) is useful because it demonstrates direct CI measurement through observable practices, while ECIC changes the information sources and decision context rather than reusing business items.

Content validity should precede statistical modeling. Teachers can judge whether items reflect practice, families can assess governance and communication, and CI specialists can test conceptual fidelity. Pilot data should then address dimensionality, reliability, discriminant validity, and measurement invariance. Figure 3 emphasizes validation before composite scoring.

4.7. How Ecic May Enhance Reading Comprehension

The title is "enhancing" but it is actually a process claim and not a causal effect. There is inconsistent definition and measurement of inferencing, hence the need for outcome specification (Rice et al., 2024). It is hoped that by improving decision quality and timeliness, ECIC will also help ensure that book difficulty, questioning, vocabulary support, narrative prompts, multilingual options, and digital features are aligned to children's needs.

The pathway, not an individual correlation, should be tested in a future study. ECIC can be assessed at the teacher level, via a reading decision, and be tied to child outcomes in the literal, inferential, vocabulary, and narrative areas. Multilevel modeling should take into account the clustering and longitudinal data should be used to test the feedback and learning.

Information does not always bring about the best results. Too much observing can lead to too much work; not conveying the analysis well can leave good analysis stranded; weak governance can be a loss of

trust; and use without feedback can maintain ineffective routines. For ECIC, it is not data intensity (Beatson et al., 2025; Madureira et al., 2023) but balanced information conversion.

4.8. Practical and Theoretical Implications

Leaders: ECIC recommends more rigorous but lighter routines ask a decision question, gather only relevant evidence, take note of observations from interpretation, note uncertainty, state responsibility, and set a review date. Picture-book planning can then serve as an intelligence forum in addition to the book-selection discussion.

One wrong answer is not a red flag for teachers. Convergence in retelling, discussion, sequencing and later use is more informative. Additionally, comprehension and expressive-language limits can be separated by using gesture, drawing, home-language response, or visual sequencing (Grøver et al. 2020; MacLeod & Pesco 2023).

The article expands the capability logic of the CI theory to a public-service educational environment, while keeping the same unit of analysis, that of the organization. The challenge of signals, meaning, time-sensitive decisions, and feedback to drive learning is a well-recognized intelligence problem for early-childhood institutions. Planning, scanning, acquisition, analysis, dissemination, utilization, feedback and governance can then be studied without the import of commercial objectives.

4.9. Research Agenda

The immediate priority is measurement validation. Cognitive interviews and expert review should refine the 24 items before a multi-site field study compares plausible measurement specifications. The eight domains should be tested rather than assumed to be distinct, and governance should not be forced into a higher-order factor solely for convenience. Table 5 summarizes these validation priorities.

Table 5. Research agenda for ECIC validation

Research priority	Current limitation	Recommended next design
Content validity	The 24 items are review-derived and unvalidated.	Cognitive interviews with teachers; expert review by early-childhood, measurement and CI specialists; family review of governance items.
Measurement quality	No factor structure, reliability or invariance evidence exists.	Multi-site field survey; compare reflective and composite specifications; test domain distinctiveness and higher-order structure.
Process validity	A questionnaire alone cannot show that intelligence changes decisions.	Decision logs that trace signal → analysis → dissemination → action → outcome → feedback.
Outcome validity	Comprehension is multidimensional and child-level.	Use literal, inferential, vocabulary and narrative outcomes; model teacher/classroom clustering.
Temporal validity	Feedback and organizational learning require time.	Longitudinal repeated measurement of ECIC, decisions and child outcomes.
Cultural / linguistic validity	Book use, family roles and governance differ across systems.	Formal translation/adaptation, multilingual response options and cross-context measurement invariance.

Note. Recommended designs are prospective and follow gaps identified in educator data-use and CI maturity research (Beatson et al., 2025; Madureira et al., 2023). No empirical validation data are claimed in the present review.

A second priority is process tracing. Decision logs should follow intelligence from question to review: signal, source, interpretation, decision, responsible actor, implementation, outcome, and feedback. Such records can reveal whether a setting scans widely but rarely acts, or acts quickly without adequate analysis.

Third, multilevel and longitudinal designs should reflect the level mismatch between organizational ECIC and child comprehension. Analyses should respect clustering, and repeated measurement should test whether feedback and retained learning improve later decisions. Experimental

work should manipulate intelligence routines rather than simply provide more data.

Finally, validation should be culturally and linguistically broad. Picture-book use, family participation, assessment, and acceptable governance vary across settings. Formal translation and adaptation are therefore required. Studies in China and other multilingual systems are especially useful where language, digital platforms, curriculum policy, and institutional governance shape evidence flow. Generalization should follow evidence, not affiliation labels.

5. Final Considerations

This review places Educational Competitive Intelligence Capability in the context of being an organizational competitive-intelligence capability to enhance the way early-childhood settings make and review their decisions about picture-book comprehension. It is a cyclical process that begins with intelligence need and scanning, continues to the acquisition of information, analysis, dissemination, utilization, feedback and governance. The contribution to CI is in the specification of how the educational signals are spread out and transformed into the intelligence products that are accountable, decisions made in teaching and learning, and learning that occurs within the organization.

Comprehended information can be manifested in varying ways in talk, retelling, vocabulary, inference, visual attention, knowledge from the family, and digital interaction in a picture book. There is no single indicator appropriate in all contexts. Shared-reading and narrative research is a means of finding evidence of effective teaching, while CI outlines how evidence can be translated into actionable teaching that can be replicated within organizations.

The theoretical contribution is the eight-domain ECIC-Cycle, the methodological contribution is a 24-item operational specification & validation pathway. All educational discoveries in the synthesis are channeled through the explicit intelligence function and decision use, which serves as a scaffolding for CI as the organizing concept, not as an extra label. The item pool allows for future testing of ECIC without implying that CI was empirically measured for this review. The composite scores and causal claims should be reserved for field validation and multi-level, longitudinal evidence.

The review is an integrative review (structured, not exhaustive) that is registered. You can't use search records to get identification counts or inter-rater statistics "retrospectively". Evidence is diverse in populations, languages, designs, and outcomes, with CI studies beyond early childhood employed for process logic and not child effects.

Subsequent research should test ECIC-Cycle with practitioners, track actual intelligence decisions and correlate capability with observable instructional changes before testing child outcomes. If adopted, the framework will differentiate between the setting that has information and the setting that turns it into timely, ethical and learning decisions.

Declarations

Ethics approval: Not applicable to the present review because no human participants, identifiable records, or primary data were collected.

Data availability: No participant-level dataset was used. The evidence base consists of the 34 cited peer-reviewed sources and the review tables in this manuscript.

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