

Operationalizing Systems Thinking Standards Across K–8 Public Education

A District-Wide Implementation Study of DSRP Cognitive Moves

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ABSTRACT: Systems thinking is increasingly advocated as an essential educational competency, yet relatively few empirical studies document how systems-thinking frameworks are operationalized within authentic K–8 public school environments. This study presents a district-wide descriptive content analysis of DSRP (Distinctions, Systems, Relationships, Perspectives) systems thinking and the six cognitive moves derived from it: Is/Is Not, Zoom In, Zoom Out, Part Party!, RDS Barbell, and Perspective Circle. Data consisted of teacher-generated instructional artifacts, lesson plans, standards-aligned curricular materials, implementation reflections, AI-supported instructional logs, and interdisciplinary classroom activities spanning preschool through eighth grade. Using a structured coding framework, 65 instructional activities were analyzed for cross-disciplinary transfer of DSRP cognitive moves, developmental progression across grade bands, operationalization of Systems Thinking Education Standards (STES®), teacher adoption of structural pedagogical language, and AI-supported instructional integration. Results demonstrated broad recurrence of DSRP structures across mathematics, literacy, science, social-emotional learning, movement, music, cooking, and interdisciplinary inquiry activities. Developmental analyses further revealed increasing cognitive complexity from concrete sensory and classification-based reasoning in preschool settings to abstract literary, perspectival, and algebraic systems reasoning in middle school classrooms. The findings also suggest increasing teacher internalization of DSRP as a structural pedagogical framework rather than as isolated terminology or scripted instructional routines. Several artifacts demonstrated explicit operationalization of STES standards into observable teacher actions, student cognitive tasks, and classroom prompts. In addition, teacher implementation logs revealed emerging integration between AI-supported instructional design and DSRP-based systems thinking. Although the present study does not establish causal claims regarding academic achievement or cognitive outcomes, it provides empirical implementation evidence that DSRP can function as a transferable, developmentally adaptable, and operationally scalable cognitive framework embedded within authentic K–8 classroom instruction. The study therefore contributes an important empirical bridge between systems-thinking theory and real-world educational practice.

KEYWORDS: Systems Thinking | DSRP Theory | Systems Thinking Education Standards (STES®) | Cognitive Moves | K–8 Education | Educational Implementation | Cognitive Development | Teacher Professional Development | Artificial Intelligence in Education | Cross-Disciplinary Learning | Structural Cognition | Curriculum Integration

Cite this paper: Nittolo, J. (2026). Operationalizing systems thinking standards across K–8 public education: A district-wide implementation study of DSRP cognitive moves. *Journal of Systems Thinking*, 6(1), 1–18. <https://doi.org/10.54120/jost.v26i1.jnostscm>

1. Introduction

Systems thinking has increasingly been recognized as an important educational competency for addressing complexity, interdisciplinary reasoning, problem-solving, and adaptive cognition. Despite broad conceptual support, most educational systems-thinking initiatives remain either:

- theoretical,
- discipline-constrained,
- enrichment-oriented,
- or insufficiently operationalized for classroom implementation.

This gap between theory and practice has limited empirical understanding of how systems thinking can function within real instructional environments.

DSRP theory [1] proposes that cognition organizes information through four universal patterns:

- Distinctions (D),
- Systems (S),
- Relationships (R),
- Perspectives (P).

From these patterns emerge six practical cognitive moves [2,3]:

1. Is/Is Not,
2. Zoom In,
3. Zoom Out,
4. Part Party!,
5. Relationship Zoom,
6. Perspective Circle.[4]

The present study examines an early-stage district-wide implementation of DSRP across a public K–8 educational system after teachers received Yellow Belt training in DSRP and STES-aligned instructional practices.

Rather than evaluating standardized achievement outcomes, the present work focuses on:

- operationalization,
- pedagogical transfer,
- developmental adaptation,

- teacher adoption,
- and implementation feasibility.

The study asks:

1. Can DSRP cognitive moves be operationalized across authentic K–8 classroom contexts?
2. Can the same cognitive structures transfer across subject domains?
3. Do teachers internalize DSRP into pedagogical language and instructional design?
4. Can STES standards be translated into observable classroom practices?

1.1 Theoretical Background

DSRP theory and O-Theory [5,6] defines thinking as the organization of information:

$$\mathbb{M} = I \cdot O$$

where:

- (I) represents information,
- (O) represents organization.

In DSRP theory, organization consists of recurring structural patterns:

- identity/other distinctions,
- part/whole systems,
- action/reaction relationships,
- point/view perspectives.

The Six Cognitive Moves operationalize these patterns into classroom-applicable thinking tools:

- Is/Is Not List,
- Zoom In,
- Zoom Out,
- Part Party!,
- RDS Barbell,
- Perspective Circle.

The Systems Thinking Education Standards (STES®) provide developmental learning standards aligned with these moves.

The current study represents an implementation investigation into whether these structures can be embedded into authentic educational practice across multiple developmental stages and subject domains.

2.0 Methods

2.1 Design

This study employed a descriptive mixed-methods content analysis of teacher-generated instructional artifacts collected during the early implementation of DSRP systems thinking and the Systems Thinking Education Standards (STES®) within a public K–8 school district. The study combined qualitative artifact analysis with structured implementation coding to examine how DSRP cognitive moves were operationalized across developmental levels and disciplinary contexts.

The study was exploratory and implementation-focused in nature. No experimental manipulation, comparison groups, or causal outcome analyses were conducted. Rather than evaluating academic effectiveness, the study sought to examine patterns of operationalization, cross-disciplinary transfer, developmental adaptation, and pedagogical integration of DSRP systems thinking within authentic classroom environments.

2.2 Data Sources and Analytic Framework

Data for the study were drawn from a district-wide collection of teacher-generated instructional artifacts produced during the early stages of DSRP and STES implementation. The dataset included lesson plans, instructional prompts, standards-aligned curricular materials, teacher reflections, AI-assisted instructional logs, classroom implementation documents, and interdisciplinary activity designs. Collectively, these materials provided a naturalistic view into how teachers translated systems-thinking concepts into authentic classroom practice.

Artifacts spanned multiple developmental levels, including preschool, elementary, and middle school settings. Instructional examples were collected from a broad range of subject domains, including mathematics, science, English language arts, literacy, social-emotional learning, music, movement, cooking, and interdisciplinary inquiry activities. This breadth allowed for examination of whether DSRP cognitive structures transferred across both disciplinary and developmental contexts.

The dataset included both explicit and embedded applications of DSRP cognitive moves. Some artifacts directly identified moves such as Is/Is Not, Zoom In, Zoom Out, Part Party!, RDS Barbell, and Perspective Circle within lesson objectives, instructional prompts, and classroom activities. Other artifacts reflected DSRP structures more implicitly through patterns of questioning, systems-oriented instructional design, collaborative inquiry, and perspectival framing. Several artifacts also documented direct integration of STES standards, including explicit mappings between standards, teacher actions, student cognitive tasks, and instructional prompts.

2.3 Coding Procedures

The primary unit of analysis was the instructional activity. Where a single artifact contained multiple distinct activities, each activity was coded independently. A total of 65 instructional activities were coded across the core artifact set. Supplemental AI implementation logs were coded separately because they reflected teacher implementation reporting rather than lesson-level classroom activities.

A structured coding framework was developed to support transparency and replicability of the analysis. Each activity was coded across the following dimensions:

1. Grade band,
2. Subject domain,
3. Presence or absence of the six DSRP cognitive moves,
4. Developmental cognitive complexity,
5. STES operationalization level,
6. Teacher structural language,
7. AI-supported instructional integration.

The six DSRP moves—Is/Is Not, Zoom In, Zoom Out, Part Party!, RDS Barbell, and Perspective Circle—were coded using binary presence/absence criteria based on operational definitions established prior to analysis. For example, Is/Is Not coding required evidence of distinction-making, classification, comparison, or identity/other reasoning, while Perspective Circle coding required evidence of viewpoint shifting or perspectival interpretation.

Developmental progression was analyzed using a five-level cognitive complexity scale ranging from concrete sensory manipulation to abstract and metacognitive systems reasoning. STES operationalization was coded on a three-level scale ranging from implicit alignment to explicit classroom operationalization involving direct alignment between standards, teacher actions, student actions, and instructional prompts.

The primary analyses focused on two core dimensions:

1. Cross-disciplinary transfer of DSRP cognitive structures across subject domains.
2. Developmental progression of DSRP implementation across grade bands.

Frequency counts, subject-by-move matrices, developmental complexity summaries, and descriptive implementation statistics were generated from the coded dataset. Narrative qualitative analysis was then used to contextualize and interpret the quantitative implementation patterns observed across the artifacts.

2.4 Limitations

This study has several important limitations. First, the analysis relied primarily on instructional artifacts and implementation materials rather than direct student outcome measures. Second, no comparison groups, experimental controls, or longitudinal achievement measures were included. Third, classroom observations, student interviews, and direct assessments of student cognition were limited or unavailable.

Fourth, although the study employed structured coding procedures and descriptive quantitative analysis, the dataset remains exploratory and implementation-focused in nature.

Accordingly, findings should be interpreted as evidence of implementation feasibility, operationalization, developmental adaptability, and cross-disciplinary transfer rather than causal evidence of instructional effectiveness or academic impact. Future studies incorporating longitudinal outcome measures, classroom observations, and developmentally calibrated systems-thinking assessments such as TQ (Thinking Quotient) may help extend the present findings into more robust investigations of cognitive development and instructional effectiveness.

3.0 Results

Analysis of the instructional artifacts revealed that DSRP cognitive moves were implemented across the full K–8 developmental spectrum and adapted across a wide range of disciplinary contexts. The materials demonstrated not only the presence of systems-thinking language within instruction, but also increasing integration of DSRP structures into lesson design, classroom questioning, student activities, and interdisciplinary pedagogy. To examine these implementation patterns systematically, a descriptive content analysis was conducted across 65 coded instructional activities drawn from the core artifact set. A supplemental AI implementation log was coded separately because it reflected teacher implementation reporting rather than lesson-level instructional activities.

3.1 Cross-Disciplinary Transfer of DSRP Cognitive Moves

The first analysis examined whether the six DSRP cognitive moves recurred across multiple subject domains. Each instructional activity was coded for the presence or absence of *Is/Is Not*, *Zoom In*, *Zoom Out*, *Part Party!*, *RDS Barbell*, and *Perspective Circle*.

Across the 65 coded instructional activities, the most frequently occurring move was *Part Party!* (49.2%), followed by *Is/Is Not* (43.1%), *Zoom In* (41.5%), and *Perspective Circle* (40.0%). *Zoom Out* appeared in 32.3% of activities, while *RDS Barbell* appeared in 27.7%.

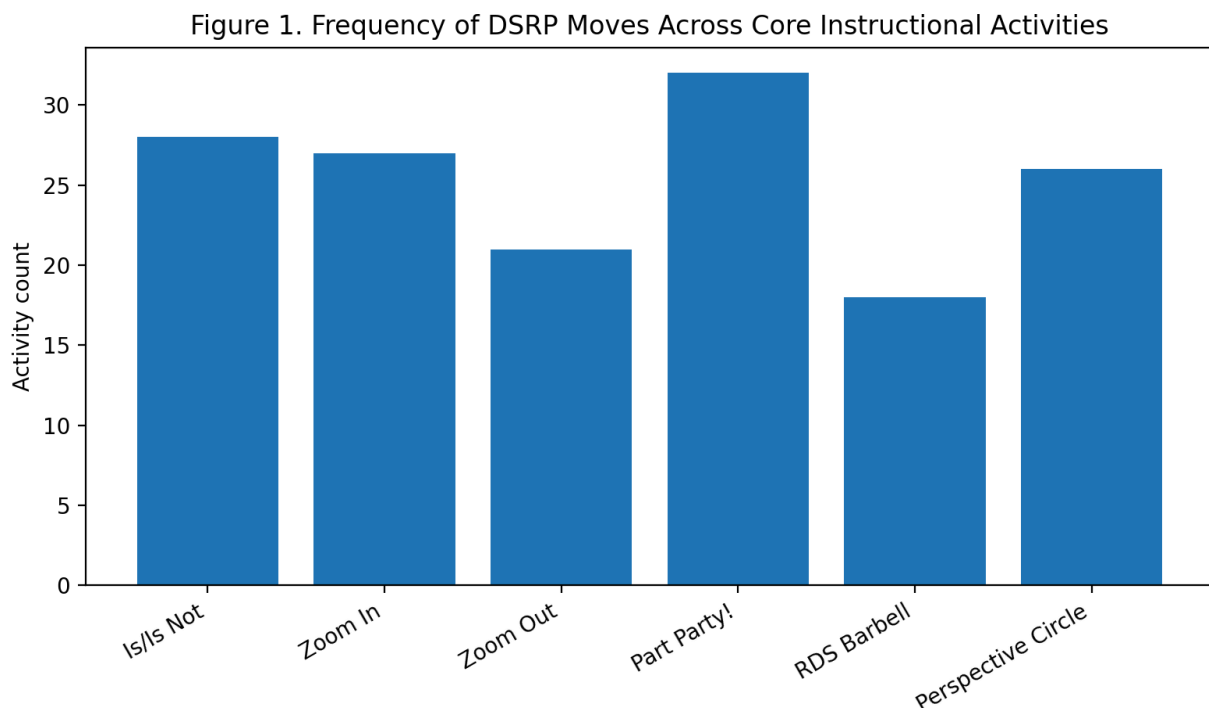
DSRP Move	Frequency	Percent of Activities
Is/Is Not	28	43.1%
Zoom In	27	41.5%
Zoom Out	21	32.3%
Part Party!	32	49.2%
Relationship Zoom (RDS Barbell)	18	27.7%

Perspective Circle	26	40.0%
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The frequency distribution suggests that teachers most commonly emphasized systems interaction, distinctions, decomposition, and perspective-taking within classroom instruction.

Figure 1. Cross-Disciplinary Transfer of DSRP Cognitive Moves Across K-8 Subject Domains.

Heatmap showing the recurrence of the six DSRP cognitive moves across mathematics, English language arts, science, social-emotional learning, cooking, movement, music, literacy, and interdisciplinary activities. The figure illustrates that the same structural thinking patterns appeared repeatedly across highly different instructional domains, supporting the interpretation of DSRP as a domain-general cognitive framework rather than a content-specific instructional strategy.



The subject-by-move matrix further demonstrated broad cross-disciplinary recurrence of DSRP structures. Is/Is Not, Zoom In, Part Party!, and Perspective Circle appeared across nearly every major subject domain represented in the dataset, including mathematics, literacy, science, cooking, movement, music, and social-emotional learning.

Subject Domain	Is/Is Not	Zoom In	Zoom Out	Part Party!	RDS Barbell	Perspective Circle
Art	0	6	4	7	1	3
Science & Health	5	6	5	8	3	5
ELA	5	5	6	8	6	8

Literacy	9	12	8	8	7	13
Mathematics	7	11	11	12	4	4
Movement	4	5	2	2	2	1
Music	6	3	2	3	2	3
Science	9	7	4	11	6	7
SEL	10	1	2	7	5	12
Social Studies	0	1	1	0	0	1

This pattern strongly supports the interpretation that DSRP functioned as a domain-general instructional scaffold rather than a content-specific intervention. The same cognitive structures repeatedly appeared across highly different instructional contexts, suggesting that teachers were using DSRP as an underlying framework for organizing cognition itself rather than as an isolated curricular strategy.

Narrative analysis of the artifacts reinforced these quantitative findings. In early childhood settings, DSRP structures appeared through classification, sound exploration, collaborative inquiry, physical systems exploration, and emotional perspective-taking. Preschool lessons engaged students in identifying and comparing sounds, sorting objects, solving classroom problems collaboratively, exploring relationships among materials, and participating in movement-based systems activities. These activities frequently embedded distinctions, systems, relationships, and perspectives within developmentally appropriate sensory and social experiences.

At the elementary level, DSRP integration became increasingly interdisciplinary and cognitively explicit. Third-grade science and ELA materials incorporated syntopical reading, TWR sentence structures, graphing, systems reasoning, informational synthesis, and classification activities related to inherited and learned traits. Teachers embedded systems-thinking structures into vocabulary instruction, nonfiction analysis, biography writing, phonics instruction, historical reasoning, and interdisciplinary literacy activities. Rather than isolating systems thinking as a separate instructional component, the artifacts suggested that DSRP increasingly functioned as an underlying cognitive framework integrated into existing curricular practice.

At the middle school level, DSRP structures were applied to more abstract forms of reasoning and analysis. Eighth-grade ELA materials used distinctions, relationships, systems, and perspectives to scaffold literary analysis, including foreshadowing, causal mapping, relationship analysis, and perspective-taking. Students completed Is/Is Not charts, visual relationship webs, analytical writing activities, and perspective analyses designed to support interpretation of literary texts and authorial intent. *The Lemonade War: DSRP Edition* similarly organized literary analysis around each DSRP pattern, guiding students through distinctions between characters, systems analysis of business structures, relationship mapping of sibling conflict, and perspective-taking exercises related to narrative interpretation.

Mathematics instruction also reflected increasing structural sophistication. Algebra lessons incorporated graph interpretation, structural reasoning, algebraic explanation, and TWR-based explanatory thinking within lessons on absolute value equations, inequalities, and irrational numbers. These activities suggested that DSRP was being used not simply as a discussion framework, but as an organizational scaffold for procedural and conceptual mathematical reasoning.

3.2 Developmental Progression of DSRP Implementation

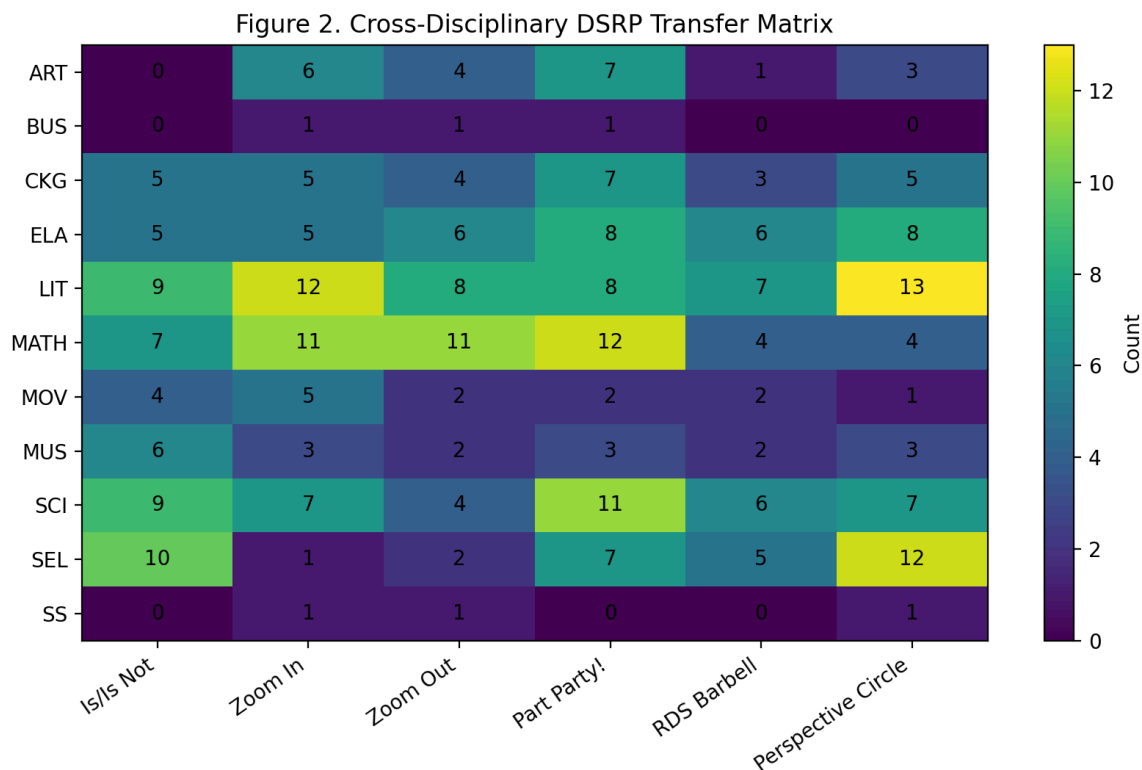
The second major analysis examined developmental progression of DSRP implementation across grade bands. Each activity was coded for dominant cognitive complexity using a five-level developmental scale ranging from concrete sensory manipulation to recursive or metacognitive systems analysis.

Grade Band	Activity Count	Mean Complexity	Median Complexity
Preschool	40	2.33	2
K–3	9	3.00	3
Grades 4–5	5	4.20	4
Grades 6–8	11	4.09	4

The results demonstrated a clear increase in cognitive abstraction and structural complexity across developmental levels.

Figure 2. Developmental Progression of DSRP Systems Thinking Across Grade Bands.

Developmental progression model illustrating increasing abstraction and structural complexity of DSRP implementation from preschool through middle school. Early childhood activities emphasized sensory distinctions, concrete systems, and physical relationships, while upper-grade activities increasingly involved abstract literary analysis, causal reasoning, perspectival interpretation, and algebraic systems thinking.



Preschool activities most frequently involved sensory distinctions, concrete manipulation, movement systems, object classification, and simple relational reasoning. Elementary-level activities increasingly incorporated literacy systems, graphing, sentence structures, trait classification, informational synthesis, and interdisciplinary reasoning tasks. By middle school, activities demonstrated substantially greater abstraction through literary analysis, causal mapping, algebraic explanation, systems interpretation, and perspectival reasoning.

The progression analysis suggests that the underlying DSRP structures remained relatively stable across grade bands while the informational and cognitive complexity layered onto those structures increased developmentally.

Figure 3. Frequency of DSRP Cognitive Moves Across Instructional Artifacts. Frequency distribution of the six DSRP cognitive moves coded across instructional artifacts in the district-wide implementation dataset. Part Party!, Is/Is Not, Zoom In, and Perspective Circle appeared most frequently, suggesting strong emphasis on systems interaction, distinctions, decomposition, and perspective-taking within classroom instruction.

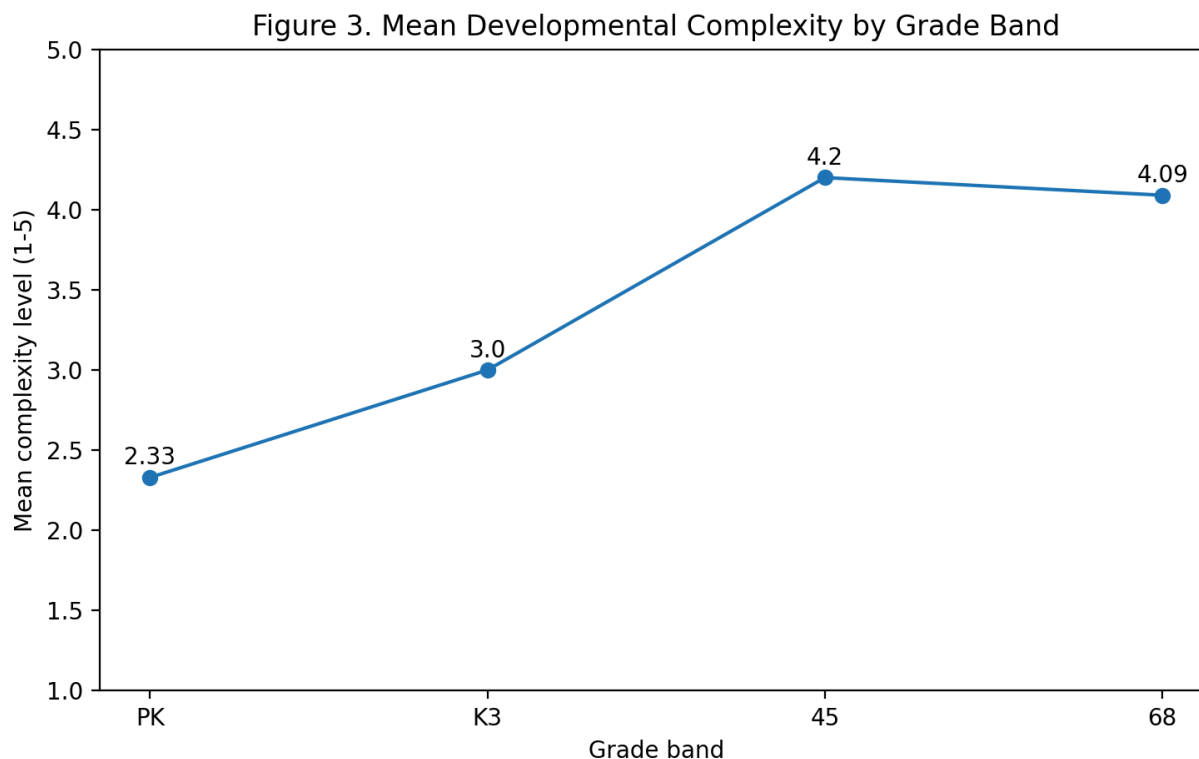
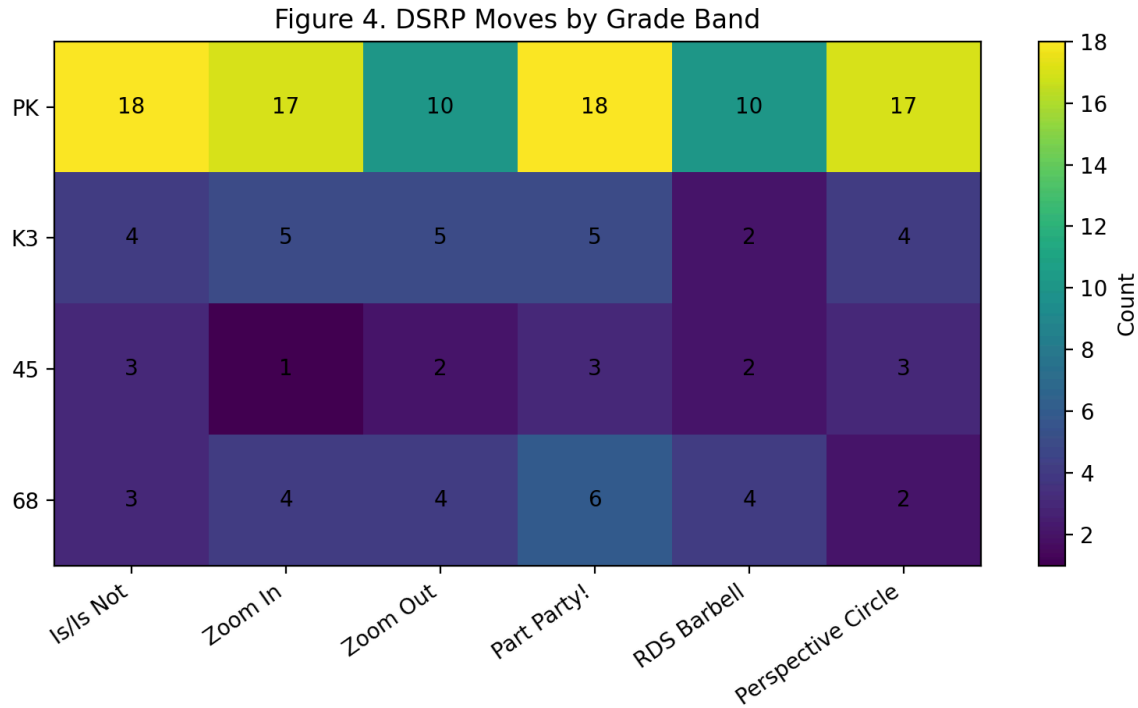


Figure 4. Developmental Complexity of DSRP Implementation Across K-8 Grade Bands. Mean developmental complexity scores across grade bands based on coded instructional artifacts. Complexity increased progressively from concrete sensory and classification-based activities in preschool and early elementary settings toward increasingly abstract relational, analytical, and systems-based reasoning in middle school classrooms.



3.3 STES Operationalization

A separate coding analysis examined the degree to which Systems Thinking Education Standards (STES®) were operationalized into observable classroom practice.

STES Operationalization Level	Frequency	Percent
Implicit Alignment	44	67.7%
Explicit STES Language	10	15.4%
Full Operationalization	11	16.9%

The strongest examples of STES operationalization appeared in the *Molding Dough* and *Pizza* lessons, where teacher actions, student actions, DSRP moves, prompting language, and developmental adaptations were explicitly aligned into coherent instructional sequences. These lessons operationalized distinctions through classification activities, systems through decomposition of recipes and ingredient structures, relationships through tool–ingredient interactions, and perspectives through prompts comparing recipe viewpoints and student choices.

The findings suggest that STES standards were not functioning merely as abstract descriptors, but were translated into observable teacher behaviors, measurable instructional structures, and authentic student cognitive activities embedded directly into classroom practice.

3.4 Teacher Internalization and AI-Supported Instruction

Teacher language within the artifacts also suggested increasing internalization of DSRP structures into pedagogical cognition. Rather than simply naming the moves, teachers increasingly embedded structural reasoning into prompts and instructional dialogue. Examples included prompts such as “From the recipe’s perspective...,” “What relationship do you see between this spoon and the flour?,” and references to “visual warning webs showing DSRP Relationships.” These patterns suggest that teachers were beginning to internalize DSRP as a way of structuring instructional thinking rather than merely inserting isolated terminology into lessons.

Finally, teacher reflections and implementation logs documented increasing integration of AI-supported instructional design alongside DSRP-based pedagogy. Teachers reported using tools such as Claude, Gemini, ChatGPT, SchoolAI, and TWR AI to support benchmark generation, rubric creation, review games, systems-analysis activities, instructional simulations, and standards alignment. Several entries explicitly connected AI use to DSRP implementation, including activities involving DSRP analysis of calendars, assigning students into D, S, R, and P groups, and applying RDS Barbell structures to cause-and-effect instruction. These findings suggest an emerging coupling between AI-supported instructional design and systems-thinking pedagogy within classroom practice.

4.0 Discussion

The present study provides preliminary empirical evidence that DSRP systems thinking can be operationalized across authentic K–8 public educational environments in ways that are developmentally adaptable, pedagogically transferable, and instructionally embedded. Although the current dataset does not permit causal claims regarding student achievement or long-term cognitive outcomes, the implementation artifacts and descriptive content analysis reveal several important patterns with implications for systems-thinking education, curriculum design, teacher cognition, and educational scalability.

One of the most significant findings was the highly interdisciplinary nature of implementation. Quantitative coding demonstrated that the six DSRP cognitive moves recurred across mathematics, science, English language arts, literacy, social-emotional learning, movement, music, cooking, and interdisciplinary inquiry activities. The subject-by-move matrix and cross-disciplinary transfer analysis showed especially broad recurrence of *Is/Is Not*, *Zoom In*, *Part Party!*, and *Perspective Circle* across diverse instructional domains. These findings suggest that DSRP functioned not as a discipline-specific framework, but as a transferable cognitive architecture repeatedly adapted to different instructional goals and content areas.

This interdisciplinary recurrence is theoretically important because most educational interventions remain tightly tied to specific disciplines or isolated instructional contexts. In contrast, the present findings suggest that DSRP may possess a level of domain generality uncommon among educational frameworks. Distinctions, systems, relationships, and perspectives were used not only to analyze literary characters or scientific traits, but also to structure cooking activities, movement exercises, collaborative inquiry,

emotional reasoning, graph interpretation, and algebraic explanation. The recurrence of the same structural moves across highly different domains supports the interpretation of DSRP as a domain-general organizational framework for cognition rather than a content-specific instructional strategy.

A second major finding involved developmental progression across grade bands. The developmental complexity analysis demonstrated a clear increase in cognitive abstraction from preschool through middle school, with mean complexity scores increasing from 2.33 in preschool settings to approximately 4.0 in upper-grade classrooms. While younger students engaged DSRP primarily through sensory distinctions, classification, movement systems, and concrete relational activities, older students increasingly applied the same structures to abstract literary analysis, perspectival interpretation, causal mapping, and algebraic systems reasoning.

Importantly, the underlying cognitive structures remained relatively stable across developmental levels even as informational complexity increased. Preschool students engaged distinctions through sorting and sound identification, while middle school students used distinctions to analyze literary foreshadowing and mathematical structure. Similarly, systems reasoning appeared first through collaborative building and recipe decomposition before later appearing in ecosystem analysis, historical reasoning, and algebraic explanation. This continuity suggests that DSRP may function as a developmental cognitive scaffold capable of supporting increasingly sophisticated forms of reasoning across educational stages.

The findings also suggest that teachers began internalizing DSRP structurally rather than merely procedurally. In many educational initiatives, implementation remains superficial, with teachers adopting terminology without substantially altering instructional cognition. However, the present artifacts revealed increasingly organic use of structural prompts, systems-oriented questioning, perspectival framing, and DSRP-informed instructional design. Teachers did not simply label activities with DSRP vocabulary; rather, they embedded distinctions, systems, relationships, and perspectives into the logic of classroom interaction itself.

Prompts such as “From the recipe’s perspective...,” “What relationship do you see between this spoon and the flour?,” and requests for students to create “visual warning webs” suggest that teachers were beginning to think structurally about learning rather than merely complying with a training initiative. This distinction is important because durable educational change often depends less on scripted implementation and more on whether educators internalize the cognitive model underlying the pedagogy.

Another important finding involved the operationalization of the Systems Thinking Education Standards (STES®). Many educational standards frameworks remain abstract, aspirational, or difficult to observe within authentic classroom practice. In contrast, several artifacts in the present dataset explicitly translated STES standards into concrete teacher behaviors, student cognitive actions, instructional prompts, and developmental adaptations. The *Molding Dough* and *Pizza* lessons were especially illustrative in this regard, mapping DSRP moves directly onto observable instructional interactions involving classification, decomposition, systems reasoning, relationship analysis, and perspective-taking.

The STES operationalization analysis further demonstrated that while most artifacts showed implicit standards alignment, a meaningful subset demonstrated full operationalization involving explicit alignment between standards, teacher actions, student actions, and instructional prompts. These findings

suggest that STES standards may possess an unusual degree of operational clarity compared to many educational standards frameworks, allowing teachers to move more directly from conceptual theory into observable classroom practice.

The dataset also revealed early signs of an emerging relationship between AI-supported instructional design and systems-thinking pedagogy. Teachers reported using AI tools such as Claude, Gemini, ChatGPT, SchoolAI, and TWR AI to generate benchmarks, rubrics, review games, simulations, standards-aligned instructional materials, and systems-thinking activities. Importantly, the artifacts suggest that AI was not being used merely for generic automation or productivity enhancement. In several cases, teachers explicitly used AI to extend, reinforce, or operationalize DSRP structures within classroom instruction itself.

This finding raises important future research questions regarding the interaction between cognitive frameworks and artificial intelligence. Systems-thinking structures such as DSRP may provide a scaffold that helps educators use AI more intentionally, structurally, and pedagogically, rather than relying on shallow or purely procedural forms of AI integration. Conversely, AI tools may accelerate the scalability and accessibility of systems-thinking implementation by helping teachers rapidly generate structurally aligned instructional materials and activities.

Taken together, the findings suggest that DSRP may possess several characteristics associated with scalable educational frameworks: developmental continuity, cross-disciplinary transferability, operational clarity, pedagogical internalization, and compatibility with existing curricular systems. At the same time, the present study remains exploratory and implementation-focused. Although the dataset provides strong evidence that teachers can operationalize systems thinking across authentic educational environments, it does not yet establish whether these practices produce measurable long-term improvements in student cognition, academic achievement, transfer performance, or metacognitive development.

Nevertheless, the implementation evidence itself is important. Much of the systems-thinking literature remains conceptual or theoretical, with relatively few studies documenting how systems-thinking frameworks function within real public-school classrooms across multiple developmental stages and subject areas. The present study therefore contributes an important empirical layer to the field by demonstrating that DSRP and STES can move beyond theory into sustained instructional practice within a district-scale educational environment.

4.1 Future Research

The present study represents an early-stage implementation analysis rather than a causal effectiveness investigation, and therefore opens several important directions for future research. Most immediately, future work should examine whether the implementation patterns observed in the current dataset correspond to measurable changes in student cognition, academic performance, metacognitive development, or transfer capacity across disciplines. While the current findings demonstrate that DSRP structures can be embedded into authentic classroom instruction, additional research is needed to determine the extent to which repeated exposure to these structures influences learning outcomes over time.

One particularly important direction involves longitudinal investigation of cognitive development. The present analysis demonstrated developmental continuity in how distinctions, systems, relationships, and perspectives emerged from preschool through middle school, with complexity scores increasing systematically across grade bands. Future longitudinal studies could examine whether repeated engagement with DSRP moves produces cumulative developmental effects in systems reasoning, problem-solving, perspective-taking, or interdisciplinary transfer. Such work could help clarify whether systems thinking functions primarily as a teachable skill set, a developmental cognitive scaffold, or a broader organizational framework for learning itself.

Additional research should also explore transfer effects across disciplinary contexts. The present content analysis revealed recurring DSRP structures across mathematics, literacy, science, social-emotional learning, movement, music, and creative inquiry activities. Future studies could investigate whether students who repeatedly practice the same structural cognitive moves across multiple domains develop greater capacity for far transfer, interdisciplinary reasoning, or flexible problem-solving. Because many educational interventions fail to transfer beyond the immediate instructional context, understanding the transfer potential of DSRP may represent one of the most theoretically important future directions.

The findings also point to the need for more formalized systems-thinking assessment instruments capable of measuring structural cognition directly across developmental stages. Although the present study did not include formal student outcome measures, an existing assessment framework already exists in the form of TQ (Thinking Quotient), a systems-based assessment instrument designed to measure structural thinking capacity across distinctions, systems, relationships, perspectives, and related cognitive operations. Future work could adapt and redesign the TQ framework specifically for K–8 educational contexts, creating developmentally calibrated measures appropriate for different grade bands.

Such an instrument could provide a longitudinal method for assessing systems-thinking growth, interdisciplinary transfer, metacognitive development, and structural reasoning over time. A K–8 adaptation of TQ would also allow future studies to move beyond implementation-focused analysis toward more direct measurement of cognitive development and instructional impact.

Future investigations should additionally examine implementation fidelity and teacher cognition more systematically. The current findings suggest that many teachers began internalizing DSRP structurally rather than merely procedurally, but future classroom observation studies could clarify how teacher expertise, instructional fluency, and pedagogical adaptation evolve over time. Coding studies examining teacher prompts, student responses, classroom discourse, and instructional sequencing may help identify the conditions under which systems-thinking pedagogy becomes most sustainable and effective.

Finally, the emerging integration of AI-supported instructional design alongside DSRP implementation presents an important area for future inquiry. The present dataset suggests that teachers were already using AI tools to generate systems-oriented lessons, assessments, simulations, and instructional supports. Future research may investigate whether systems-thinking frameworks such as DSRP can improve the quality, intentionality, or structural coherence of AI-assisted instruction, as well as whether AI tools themselves can accelerate the scalability of systems-thinking education.

Potential future studies may therefore include longitudinal developmental analyses, pre/post achievement investigations, systems-thinking transfer assessments, classroom observation coding, implementation fidelity studies, experimental examinations of AI-supported structural cognition, and developmentally calibrated TQ-based assessment research across K–8 educational settings.

5.0 Conclusion

This district-wide implementation study demonstrates that DSRP systems thinking and the Systems Thinking Education Standards (STES®) can be operationalized across authentic K–8 public educational environments in ways that are developmentally adaptable, interdisciplinary, and instructionally embedded. Across preschool, elementary, and middle school settings, teachers integrated distinctions, systems, relationships, and perspectives into mathematics, literacy, science, social-emotional learning, movement, cooking, music, and collaborative inquiry activities. The collected artifacts and descriptive content analysis revealed not only cross-disciplinary transferability, but also increasing evidence of teacher pedagogical adoption and structural internalization of DSRP-based thinking practices.

Importantly, the findings suggest that systems thinking need not function as a separate curricular initiative detached from everyday instruction. Instead, DSRP appeared capable of operating as an underlying cognitive framework woven directly into authentic classroom practice. Teachers adapted the same core structures across developmental levels and content areas while embedding systems-thinking prompts into instructional dialogue, literacy practices, collaborative inquiry, problem-solving, and instructional design. The operationalization of STES standards into observable teacher actions and student cognitive tasks further demonstrated that systems-thinking standards can move beyond abstract theoretical language into concrete educational practice.

The study also revealed early evidence of emerging integration between AI-supported instructional design and DSRP-based pedagogy. Teachers increasingly used AI tools not simply for automation, but to support systems-oriented lesson generation, assessment design, structural instructional planning, and systems-thinking activities. These findings suggest that future educational environments may increasingly combine systems-thinking frameworks with AI-assisted cognitive scaffolding.

Although the present study does not establish causal claims regarding academic outcomes or cognitive gains, it provides important implementation evidence within a real-world district context. Much of the systems-thinking literature remains conceptual or theoretical, with relatively few studies documenting how systems-thinking frameworks operate across authentic public-school environments. The present work therefore contributes an important empirical bridge between theory and practice by demonstrating that DSRP and STES can be translated into sustained instructional activity across diverse grade levels and disciplinary settings.

Taken together, the findings suggest that DSRP may possess several characteristics associated with scalable educational frameworks: developmental continuity, cross-disciplinary adaptability, operational clarity, compatibility with existing curricula, emerging integration with AI-supported instruction, and the potential for future assessment through developmentally adapted TQ (Thinking Quotient) instruments. As such, the study contributes early empirical evidence toward understanding how systems thinking can

move from abstract conceptual theory into operational educational practice within authentic K–8 learning environments.

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