Cross-Cultural Education Studies
https://journals.niepublish.com/cces

ARTICLE

Integrating Bilingual Literacy through Thematic Instruction at Ukrainian-English Bilingual School

Nataliia Tokareva [1] , ***Maryna Tsehelska*** [2*]

[1] *Psychology Department, Kryvyi Rih State Pedagogical University, Kryvyi Rih 50000, Ukraine*

[2] *English Language and Methodology Department, Kryvyi Rih State Pedagogical University, Kryvyi Rih 50000, Ukraine*

ABSTRACT

This article investigates the integration of bilingual literacy through thematic instruction at a specialized bilingual primary school in Ukraine. The study addresses the pedagogical challenges inherent in "artificial bilingualism," where learners navigate a complex triad: Russian as the home language (L1), Ukrainian as the primary language of instruction (L2), and English as a foreign language (L3). Central to this research is the Integrated Literacy Development Approach (ILDA), which utilizes Flavell's metacognitive framework and Vygotsky's sociocultural theory to bridge linguistic gaps through structured scaffolding. The pedagogical design combines thematic content units, such as "Transport" and "Food," with multimodal tools including bilingual concept maps and "grammar rulers." These metacognitive schemes enable Grade 1 students (ages 6–7) to categorize vocabulary and visualize syntactic structures across languages. The methodology employs a mixed-methods approach, utilizing classroom observations, semi-structured interviews, and statistical analysis via Fisher's φ-criterion. Results indicate a significant improvement in bilingual proficiency, with successful sentence construction rising from 40.0% to 86.7% ($p < 0.01$) over two semesters. Qualitative data from teacher interviews and field notes reveal that visual scaffolds facilitate cross-linguistic transfer and enhance self-correction capabilities. The study concludes that intentional metacognitive scaffolding reduces cognitive load and prevents linguistic interference. These

*CORRESPONDING AUTHOR:
Maryna Tsehelska, English Language and Methodology Department, Kryvyi Rih State Pedagogical University, Kryvyi Rih 50000, Ukraine; Email: mtsehelska4@yahoo.com

ARTICLE INFO
Received: 3 July 2025 | Revised: 3 June 2026 | Accepted: 10 June 2026 | Published Online: 17 June 2026
DOI: https://doi.org/10.63385/cces.v2i1.100721

CITATION
Tokareva, N., Tsehelska, M., 2026. Integrating Bilingual Literacy through Thematic Instruction at Ukrainian-English Bilingual School. Cross-Cultural Education Studies. 2(1): 74–90. DOI: https://doi.org/10.63385/cces.v2i1.100721

findings offer critical implications for curriculum design and teacher training in international contexts where students must achieve academic literacy in a foreign tongue while simultaneously developing their national language proficiency.
Keywords: Bilingual Literacy; Thematic Instruction; Artificial Bilingualism; Language Awareness; Ukrainian-English Integration; Concept Maps; Metacognitive Schemes; Multimodal Activities

1. Introduction

The rapid digital transformation of contemporary society has significantly influenced the cognitive and linguistic behaviors of modern learners, particularly those developing within complex bilingual educational environments. As digital natives, young students increasingly demonstrate preferences for visual processing, multitasking, and simplified language structures. While these tendencies may support rapid information intake, they simultaneously present challenges for bilingual education, where the development of deep linguistic competence and sustained cognitive engagement remains essential for long-term academic success.

Within many Eastern European educational contexts, schools operate under conditions of artificial bilingualism, a phenomenon in which multiple languages are acquired through structured educational exposure rather than natural immersion. Artificial bilingualism typically emerges when children use one language predominantly in the home environment (e.g., Russian), receive formal schooling in the national language (Ukrainian), and are simultaneously introduced to an additional foreign language (English) as part of formal education. Unlike natural bilingualism, which develops through continuous social interaction across languages, artificial bilingualism requires deliberate pedagogical mediation. In such contexts, language acquisition cannot rely on environmental exposure alone; instead, it must be intentional, systematically scaffolded, and supported through metacognitive instructional strategies to ensure the development of functional academic literacy across languages.

The relevance of artificial bilingualism to the present study lies in its direct impact on learners' language awareness, cognitive load, and transfer processes between languages. Learners navigating three linguistic systems simultaneously often demonstrate uneven development across languages, fragmented conceptual mapping, and reliance on dominant-language cognitive frameworks. Therefore, pedagogical models designed for artificial bilingual contexts must explicitly support cross-linguistic transfer, conceptual integration, and structured language production.

To address these challenges, the Integrated Literacy Development Approach (ILDA) was developed as a pedagogical framework aimed at bridging the gap between content knowledge acquisition and linguistic production. The development of ILDA emerged from classroom-based experimentation in bilingual primary education settings in Ukraine, where educators observed that traditional foreign language instruction models—primarily based on vocabulary memorization and isolated grammar practice—were insufficient for supporting academic language development in bilingual learners. ILDA evolved as a response to the need for an integrated system combining cognitive development, literacy formation, and cross-linguistic awareness.

Historically, ILDA integrates principles from several theoretical traditions, including sociocultural learning theory, metacognitive learning theory, and genre-based literacy instruction. The approach was refined through iterative classroom implementation and action research cycles, particularly within bilingual educational environments where subject content is distributed across multiple languages. Over time, ILDA developed into a structured methodology emphasizing the interdependence of language, cognition, and academic literacy.

The approach was specifically selected for inclusion in the present study due to its strong alignment with the linguistic realities of artificial bilingual educational environments. Unlike traditional foreign language instruction models, ILDA moves beyond rote memorization and isolated skill development by integrating language learning with conceptual and thematic knowledge construction. The approach is operationalized through three core pedagogical mechanisms: visual scaffolding through concept maps that anchor new vocabulary and knowledge within shared thematic structures; metacognitive regulation through algorithmic schemes that help young learners plan, monitor, and evaluate their language production; and genre-based instruction that gradu-

ally transitions students from word-level recognition toward structured, contextually appropriate discourse production.

A central feature of ILDA is the systematic use of concept maps and metacognitive schemes, including tools such as the "grammar ruler," which function as cognitive bridges between languages. During early instructional stages, bilingual concept maps present Ukrainian and English vocabulary in parallel, supporting associative learning and conceptual alignment. As learners progress and reach key cognitive milestones, instruction shifts toward parallel mapping, where students construct independent linguistic structures in each language while maintaining shared conceptual frameworks. This progression supports the development of metalinguistic awareness, enabling learners to recognize syntactic, lexical, and semantic patterns across languages.

Through the implementation of ILDA, educators are able to transform fragmented multilingual exposure into a coherent bilingual literacy system. The present study examines the application of ILDA through thematic instruction units focused on "Transport" and "Food and Drinks," demonstrating how structured visual and metacognitive tools can support young learners in complex, multi-layered linguistic environments characteristic of artificial bilingual educational contexts.

1.1. Literature Review and Theoretical Derivation

Bilingual education is widely recognized as a powerful framework for supporting cognitive development, metalinguistic awareness, and academic achievement among language-minority learners[1, 2]. However, contemporary research increasingly emphasizes that bilingual advantages are not automatic; rather, they depend on the quality, balance, and structure of linguistic input. This distinction is particularly relevant in contexts of artificial bilingualism, where children are exposed to multiple languages across school and home settings without full native proficiency in any single academic language. In such environments, language development requires structured and intentional pedagogical mediation rather than reliance on natural immersion alone.

From a sociocognitive perspective, teachers' beliefs about bilingualism strongly influence instructional effectiveness[3] demonstrate that educators who conceptualize bilingualism as a cognitive resource are more likely to implement responsive pedagogical practices. Similarly, Cummins[4] argues for moving beyond monolingual instructional models toward cross-linguistic transfer frameworks, where conceptual knowledge and academic skills developed in one language support development in another. This theoretical position forms a key foundation for structured bilingual instructional models that deliberately activate prior linguistic knowledge during new language learning.

The cognitive and linguistic benefits of bilingualism are further supported by research on metalinguistic awareness. Bialystok[5] shows that bilingual learners demonstrate stronger abilities to analyze and manipulate linguistic structures, which directly supports literacy acquisition. Complementing this perspective, Flavell's[6] theory of metacognition provides a theoretical justification for using explicit learning regulation tools, such as reflection strategies and structured visual organizers, to support young learners in monitoring and regulating their own learning processes.

Within this framework, visual-metacognitive instructional tools have gained increasing attention. Concept mapping theory[7] demonstrates that visual representation of knowledge supports semantic network formation, improves comprehension, and reduces cognitive overload. In bilingual contexts, these advantages are amplified because concept maps allow simultaneous organization of conceptual and linguistic information. Extending this work to language pedagogy, Tokareva and Tsehelska[8] show that metacognitive schemes support grammatical internalization and meaningful vocabulary structuring in early bilingual learners. These findings are particularly relevant in Ukrainian multilingual educational environments, where learners frequently navigate Russian, Ukrainian, and English simultaneously[9, 10].

However, existing research also identifies limitations in the use of visual tools. Concept maps may be less effective if learners are not explicitly trained in interpreting visual hierarchies, and overly complex maps can increase cognitive load rather than reduce it[7]. Additionally, visual organization alone does not guarantee language production unless combined with structured output scaffolding. These limitations highlight the need for integrated pedagogical systems that combine visual mapping with algorithmic language production supports.

The integration of thematic and culturally responsive instruction further strengthens bilingual learning environments.

Thematic instruction increases engagement and retention by connecting language learning to meaningful real-world contexts[11]. Similarly, culturally responsive multilingual pedagogies help learners integrate school knowledge with their linguistic and cultural identities[12]. Within such frameworks, translanguaging is increasingly recognized as a productive learning strategy rather than interference, enabling learners to flexibly draw on multiple linguistic resources to construct meaning[13].

Vocabulary development research provides additional support for structured bilingual instruction. Evidence suggests that vocabulary knowledge is largely language-specific, meaning that lexical development in one language does not automatically transfer to another[14]. Furthermore, home language exposure and parental proficiency significantly influence language outcomes[15], reinforcing the need for schools to provide compensatory structured language input, particularly in contexts where home and school languages differ.

Thematic instruction supported by bilingual concept mapping has been shown to strengthen both vocabulary acquisition and syntactic development. Thematic units such as "Transport" or "Food and Meals" create semantic networks that support conceptual transfer and language organization[9, 16]. Introducing vocabulary through real-life contexts increases motivation and supports deeper conceptual learning[17].

From a psycholinguistic perspective, structured concept-based instruction supports the development of logical-semantic relationships essential for abstract thinking[18]. These findings support the integration of linguocognitive and discourse-based approaches into early bilingual literacy development.

Despite substantial evidence supporting bilingual education, metacognitive learning, and visual scaffolding independently, there remains limited empirical research examining the combined implementation of thematic instruction, bilingual concept mapping, and algorithmic metacognitive grammar scaffolds within early primary artificial bilingual contexts. Most existing studies focus either on natural bilingual immersion environments or on older learners. Research examining structured bilingual literacy development in early primary multilingual environments typical of Eastern European educational systems remains scarce.

To address this gap, the present study applies the Integrated Literacy Development Approach (ILDA), which integrates thematic instruction, visual concept mapping, and metacognitive grammatical scaffolding within a unified instructional system designed specifically for artificial bilingual early literacy contexts.

The selected school represents a typical example of artificial bilingual educational environments common in post-Soviet urban regions, where home language (Russian), schooling language (Ukrainian), and foreign language instruction (English) coexist but are not naturally integrated. The school was selected because it provides a stable implementation environment, consistent bilingual policy, and a student population representative of multilingual urban educational settings in Eastern Europe. While not statistically representative of all bilingual contexts, it provides a valid case for examining structured bilingual literacy interventions in artificial bilingual environments.

1.2. Sample and Implementation Context

The sample for this study comprised 30 Grade 1 students (ages 6–7) enrolled at Interclass Bilingual Primary School in Kryvyi Rih, Ukraine. The group included 14 boys and 16 girls, all of whom were in their first year of formal schooling and at the emergent stage of literacy development in both Ukrainian and English. The study was conducted over one academic year (two semesters), allowing researchers to observe both the initial bilingual mapping stage and the transition to parallel language processing.

The decision to focus specifically on first-grade learners was driven by both theoretical and pedagogical considerations. Early primary school represents a critical period for literacy formation, metalinguistic awareness development, and the establishment of cognitive learning strategies. At this stage, learners begin formal academic literacy development while still demonstrating high neurocognitive plasticity, making them particularly responsive to structured metacognitive and visual scaffolding approaches. Additionally, Grade 1 represents the point at which Ukrainian academic literacy and English foreign language learning are formally introduced simultaneously in the school context, making it an optimal stage for examining structured bilingual literacy intervention.

The school operates in a complex multilingual environment characterized by artificial bilingualism. Russian

functions as the dominant home language for most learners, Ukrainian is used as the primary medium of schooling, and English is introduced as a foreign language from the outset of formal education. This linguistic configuration creates both challenges and opportunities for balanced bilingual literacy development, particularly during the early stages of schooling when academic language foundations are established.

1.2.1. Participant Language Background and Diagnostic Procedures

Language background data were collected through a combination of parent questionnaires, school entry diagnostic screening, and teacher observational assessments conducted during the first month of the academic year.

Functional fluency in Russian was determined through parent language-use surveys combined with oral interaction screening tasks conducted during school entry interviews. These tasks included narrative retelling and picture description activities designed to assess spontaneous oral production, vocabulary range, and grammatical control.

Academic Ukrainian proficiency was assessed using school-developed literacy readiness diagnostics aligned with national primary education standards. These assessments measured letter recognition, phonological awareness, receptive vocabulary, and basic sentence comprehension. Results indicated that approximately 70% of students demonstrated passive or emerging Ukrainian academic literacy at school entry.

Previous exposure to English was determined through parent questionnaires and student self-report interviews conducted using visual prompts. These instruments indicated that approximately 75% of learners had minimal or no prior structured exposure to English, while approximately 25% had attended early childhood language clubs focused primarily on isolated vocabulary acquisition without systematic literacy instruction.

1.2.2. Instructional Context and Thematic Organization

Instruction was thematically organized around age-appropriate and contextually relevant topics drawn from learners' everyday experiences. Two core thematic units—Transport and Food and Meals—were selected based on developmental, linguistic, and curricular considerations.

The Transport theme provides concrete, visually representable vocabulary and supports early classification skills. It also enables the introduction of descriptive and comparative structures. The Food and Meals theme supports functional communicative language, cultural relevance, and narrative expansion, particularly in describing preferences, routines, and social interaction contexts. Together, these themes provide a balance between conceptual categorization and communicative functionality.

1.2.3. Implementation of the Integrated Literacy Development Approach (ILDA)

The implementation of ILDA was based on an integrated system combining thematic instruction, visual scaffolding, and metacognitive regulation. Instruction began with bilingual concept mapping, where learners interacted with visually supported lexical networks presented in Ukrainian and English simultaneously. These maps functioned as semantic anchors supporting vocabulary acquisition and conceptual organization.

As learners progressed, metacognitive schemes were introduced to support planning and monitoring of language production. These included simplified genre-based planning templates and algorithmic sentence structuring tools such as the "grammar ruler," which supported early syntactic development through symbolic visual representation.

Instruction incorporated multimodal learning modalities, including visual, kinesthetic, and verbal engagement, ensuring accessibility for diverse learning styles while strengthening conceptual encoding through multiple cognitive channels.

During the first semester, students worked primarily with bilingual concept maps and produced simple descriptive sentences in English using structured visual prompts and guided sentence frames. Ukrainian output was gradually expanded through descriptive and comparative structures. During the second semester, learners transitioned to parallel concept mapping, constructing independent conceptual networks in each language while maintaining conceptual alignment across languages. This stage supported independent lexical retrieval, syntactic differentiation, and metalinguistic reflection.

Learning consolidation occurred through role play and narrative micro-tasks, including simulated communicative scenarios and short thematic storytelling tasks designed to integrate vocabulary into meaningful discourse contexts.

1.2.4. Implementation Fidelity and Teacher Professional Development

To ensure consistent implementation of ILDA, all participating teachers completed a mandatory 20-h professional development program prior to study implementation. The workshop was delivered across five 4-h sessions and included both theoretical and applied components.

The theoretical component addressed bilingual cognitive development, metacognitive learning theory, cross-linguistic transfer, and the theoretical foundations of concept mapping and algorithmic grammar scaffolding. The applied component focused on the technical construction of bilingual concept maps, classroom integration of metacognitive schemes, and guided practice in using visual grammar tools.

Teachers participated in micro-teaching simulations, collaborative lesson design sessions, and structured feedback cycles. Training materials included standardized implementation manuals, visual template libraries, and lesson sequencing guides.

Implementation fidelity was monitored through bi-weekly classroom observations, teacher reflection logs, and peer review sessions. During these sessions, teachers analyzed student-produced concept maps and written output to ensure alignment with ILDA instructional principles.

1.3. Educational Materials

At Interclass Bilingual Primary School, the topic of "Transport" is introduced to Grade 1 students through a structured bilingual instructional model combining thematic instruction, visual scaffolding, and metacognitive regulation. This sequence of lessons incorporates visual aids, interactive tasks, and algorithmic metacognitive tools to support both language acquisition and conceptual development. The instructional design follows a gradual progression from lexical recognition to syntactic production, thereby facilitating the early formation of bilingual literacy.

A central component of this instructional framework is the systematic use of a metacognitive schematic tool referred to as the "grammar ruler". This tool is applied throughout the learning process as an elementary symbolic system designed to support the construction of syntactic structures in a foreign language. As illustrated in **Figure 1**, each graphic element corresponds to a specific grammatical category: the diamond represents an adjective, the oval denotes a noun functioning as the subject, the arrow indicates the verb or predicate, the square corresponds to an object noun, and the parallelogram represents an adverbial modifier. The schematic sequence visually models the logical-semantic structure of a sentence, enabling learners to organize lexical units into grammatically coherent utterances.

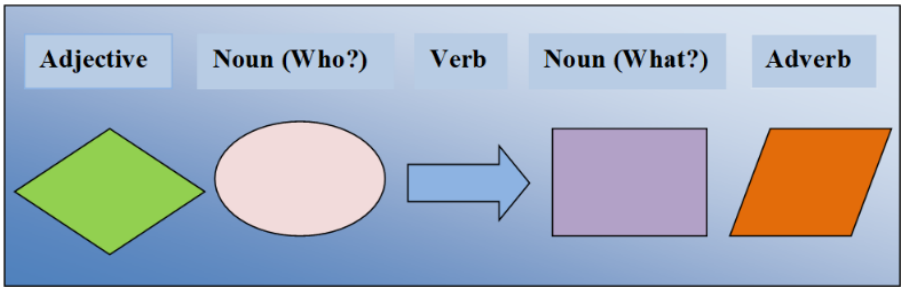

Figure 1. An Example of an Elementary "Grammar Ruler/Line"—A Scheme for Logical-Semantic.

1.4. Structuring of Sentences

Through repeated exposure to this visual grammar scaffold, learners internalize fundamental syntactic patterns and develop the ability to produce grammatically accurate and contextually appropriate sentences. Students' oral production is therefore grounded in syntactic pictograms, which simultaneously support vocabulary acquisition and conceptual learning within the thematic unit.

The thematic instructional sequence begins with classification activities in which students categorize transport vocabulary into conceptual groups. Using the "Transport" theme as a model, learners identify and classify transport types while associating each lexical item with its visual representation. This process reinforces cross-linguistic connections between Ukrainian and English and supports early

semantic network formation.

Following vocabulary introduction, students employ bilingual concept maps to classify transport types visually and analyze characteristics such as size, color, speed, cost, and comfort. As demonstrated in **Figure 2**, the concept map serves as a cognitive organizer that supports both lexical retrieval and semantic categorization. Using these visual structures, learners construct simple descriptive and comparative sentences, such as "A car is fast and comfortable," "A ship is big and slow," "The bike is cheap and fast," and "The bus is slow and comfortable." These activities are conducted bilingually, allowing students to produce parallel statements in Ukrainian and English and strengthening metalinguistic awareness through cross-linguistic comparison.

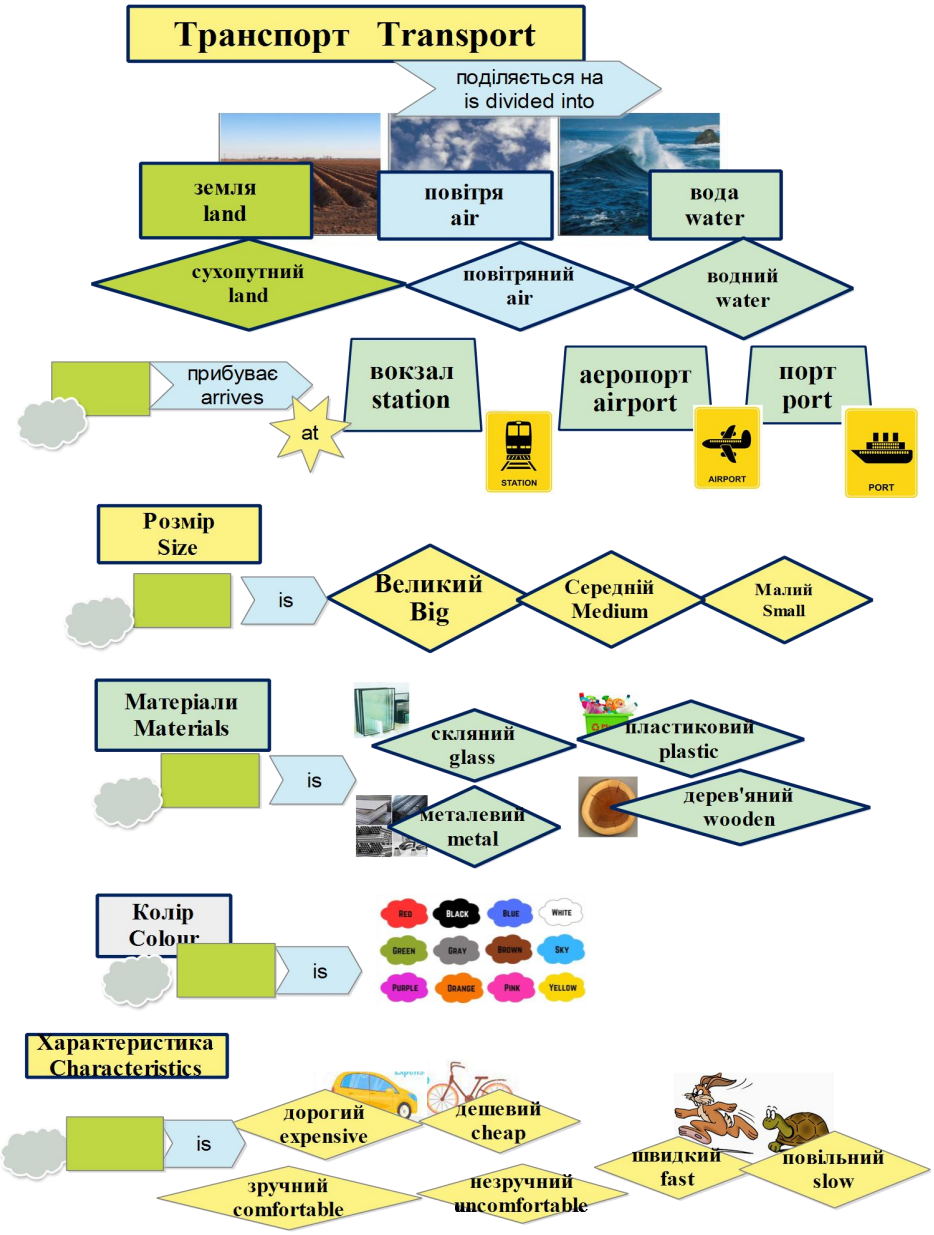

Figure 2. Concept Map "Transport".

In the second semester, learners transfer these strategies to a new thematic domain, "Food and Meals". This theme is introduced using bilingual concept maps that organize vocabulary into familiar semantic categories, including fruits, vegetables, dairy products, grains, and beverages. Initially, students work with bilingual concept maps that

present Ukrainian and English lexical units simultaneously, reinforcing word recognition and category awareness across languages.

As learners' bilingual competence develops, they transition to constructing independent concept maps in Ukrainian and English. This shift represents a significant cognitive milestone, as students begin organizing information in parallel bilingual processing mode while maintaining conceptual alignment across languages. The progression toward independent bilingual structuring is illustrated in **Figure 3**, which demonstrates the use of parallel metacognitive schemes for the thematic domain "Food and Drinks".

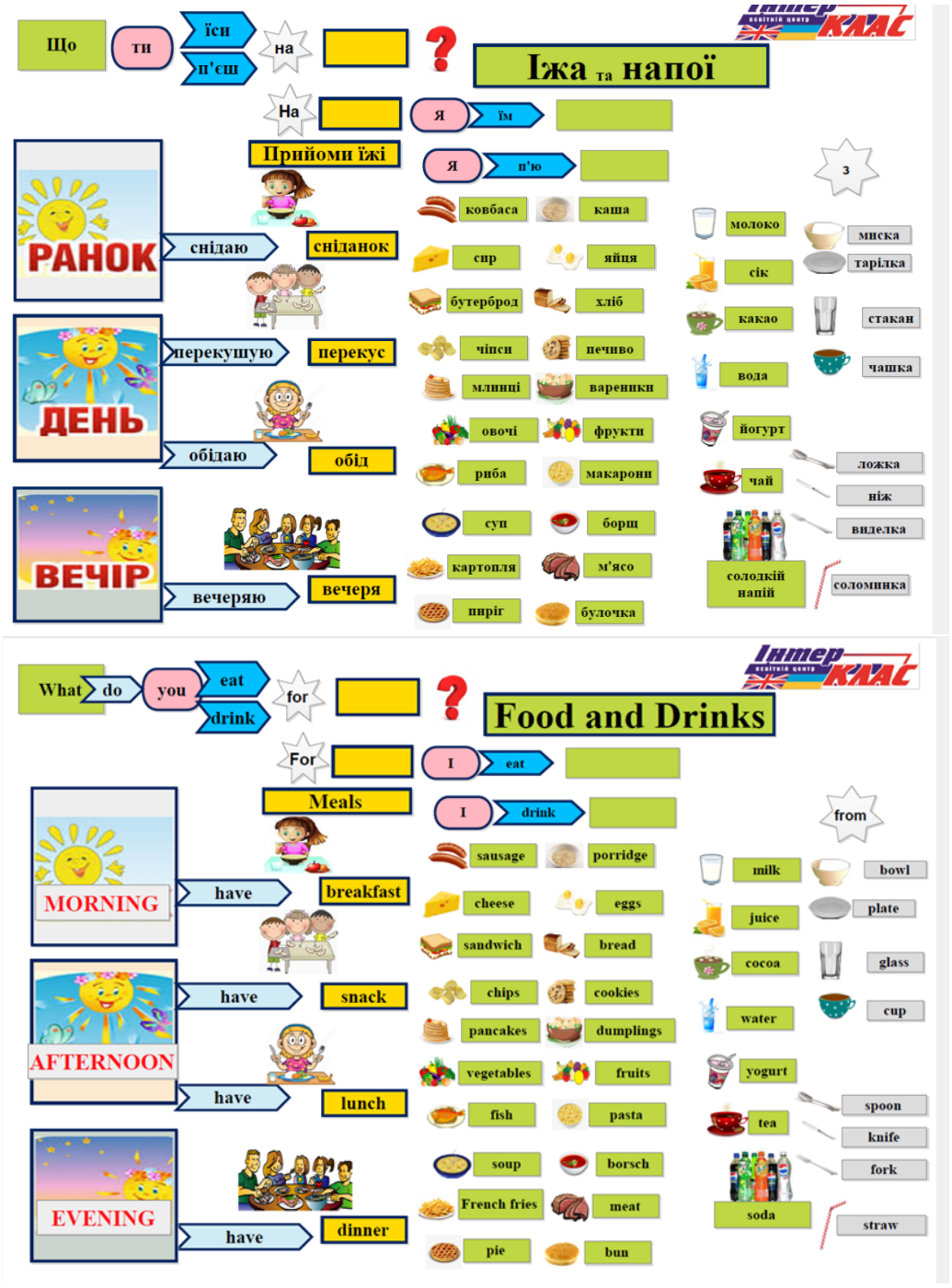

Figure 3. Metacognitive Schemes "Food and Drinks" in Ukrainian and English.

The effectiveness of the thematic ILDA-based approach is further supported by evidence of cognitive and linguistic generalization across thematic domains. Although the primary instructional focus was on "Transport" and "Food", learners demonstrated the ability to transfer metacognitive strategies to new conceptual areas. For example, during a follow-up activity on the topic "Animals", students independently applied the grammar ruler logic to produce structurally accurate descriptive sentences. One student described a cheetah as "a fast cat," correctly applying adjective-noun word order previously practiced within the transport thematic unit. This suggests that the ILDA framework supports the development of transferable cognitive-linguistic production templates rather than isolated thematic vocabulary knowledge.

From a comparative instructional perspective, baseline performance during the initial weeks of the academic year functioned as a quasi-control condition. Prior to the implementation of ILDA-based thematic instruction, students followed a standard communicative EFL curriculum. Following the transition to ILDA, classroom observations and performance assessments indicated accelerated development in sentence construction, syntactic accuracy, and bilingual lexical retrieval when compared to earlier rote-based instructional phases. These findings support the hypothesis that structured thematic instruction combined with metacognitive visual scaffolding enhances early bilingual literacy development in artificial bilingual educational contexts.

1.5. Research Methods and Techniques

The present study investigated both the theoretical and practical aspects of integrating metacognitive schemes into bilingual literacy development within an artificial bilingual educational environment at Interclass Bilingual Primary School. A mixed-methods research design was employed, combining theoretical analysis, qualitative classroom-based investigation, and quantitative statistical validation to examine the effectiveness of metacognitive strategies in supporting early bilingual literacy.

1.5.1. Theoretical and Historical Foundations

The theoretical framework of the study is grounded in two major intellectual traditions: metacognitive theory and sociocultural theory of learning.

The concept of metacognition was first systematically introduced by Flavell[6], who defined it as learners' awareness of and ability to regulate their own cognitive processes. Historically, metacognition emerged from cognitive psychology research in the 1970s and 1980s, particularly studies investigating how learners plan, monitor, and evaluate their learning strategies. In language education, metacognition has since been associated with strategic competence, self-regulated learning, and conscious language processing. Within the present study, metacognitive theory informed the design of visual planning tools such as concept maps and algorithmic metacognitive schemes (e.g., the grammar ruler), which supported students in structuring lexical and syntactic output.

Complementing this perspective, Vygotsky's sociocultural theory[19] provided the social-cognitive framework for understanding language acquisition as a mediated process occurring through interaction, scaffolding, and guided participation. Historically rooted in Soviet developmental psychology, sociocultural theory emphasizes the Zone of Proximal Development (ZPD), within which learners can perform tasks with structured support. In the present study, sociocultural theory was operationalized through teacher-guided bilingual interaction, collaborative classification tasks, and scaffolded progression from bilingual to parallel concept mapping[20].

Together, these theoretical perspectives informed the instructional design and methodological structure of the study by positioning metacognitive tools as mediational artifacts that support language internalization and bilingual literacy formation.

1.5.2. Research Design: Mixed-Methods Structure

The study followed a convergent mixed-methods design in which qualitative and quantitative data were collected simultaneously and integrated during interpretation. Data sources were distributed as follows:

Quantitative Data Sources:

- Vocabulary and sentence production assessments;
- Cross-linguistic transfer performance tasks;
- Pre- and post-intervention literacy indicators;
- Statistical comparison using Fisher's φ-criterion.

Qualitative Data Sources:

- Classroom observation protocols;

- Semi-structured teacher interviews;
- Semi-structured student interviews;
- Student-produced concept maps and written artifacts.

Empirical Methods

(1) Classroom Observation

Structured classroom observations were conducted throughout two academic semesters to document student engagement and metacognitive strategy use during bilingual literacy instruction. Observation protocols focused on:

- Engagement during thematic and concept-mapping activities;
- Use of metacognitive planning and self-monitoring strategies;
- Peer interaction during bilingual meaning negotiation;
- Teacher scaffolding behaviors.

Observation data were analyzed using qualitative content analysis, involving open coding, category formation, and pattern identification across lesson sequences.

(2) Semi-Structured Interviews

Semi-structured interviews were conducted with both teachers and students to explore perceptions of metacognitive scheme effectiveness and implementation challenges.

Interviews were conducted using a hybrid format:

- Teachers participated in individual semi-structured interviews;
- Students participated in small group interviews (3–4 learners per group) to reduce anxiety and support age-appropriate communication;

Teacher participants and demographic characteristics are described in Section 1.2. Interview protocols focused on:

- Perceived usefulness of visual metacognitive tools;
- Observed student language development patterns;
- Challenges in bilingual instructional implementation;
- Student perceptions of learning support and task clarity.

Interview data were analyzed using thematic coding, with categories derived both deductively (based on theoretical constructs such as metacognitive regulation and scaffolding) and inductively (emerging patterns from participant responses).

(3) Quantitative Statistical Analysis

To evaluate the effectiveness of the instructional intervention, one-factor variance comparison using Fisher's φ-criterion was applied. This statistical method was selected because it is appropriate for comparing proportional changes in categorical performance indicators across two measurement points (pre- and post-intervention). In the present study, Fisher's φ-criterion was used to evaluate statistically significant differences in:

- Vocabulary production accuracy rates;
- Correct syntactic structure formation;
- Successful cross-linguistic transfer performance.

Proportion values were calculated for each indicator before and after ILDA implementation. The φ value was then calculated to determine whether observed improvements exceeded chance variation. In addition to φ-criterion calculations, descriptive statistical analysis was used to calculate:

- Mean performance growth rates;
- Percentage improvement across literacy indicators;
- Distribution patterns across student performance levels.

(4) Data Integration and Triangulation

To ensure methodological rigor and validity, data triangulation was applied across multiple sources and methods. Triangulation was conducted at three levels:

- **Method Triangulation:**
  Comparison of quantitative assessment results with qualitative observation and interview findings.
- **Source Triangulation:**
  Comparison of teacher perspectives, student perceptions, and classroom performance data.
- **Artifact Triangulation:**
  Analysis of student-produced concept maps and written language samples alongside observational and statistical findings.

Through triangulation, patterns of improvement in bilingual literacy were confirmed across independent data sources, strengthening the reliability and interpretability of the findings.

2. Results

The implementation of the Integrated Literacy Development Approach (ILDA) resulted in measurable growth in bilingual linguistic proficiency and metacognitive awareness among primary school learners in an artificial bilingual environment. By leveraging visual, thematic, and algorithmic scaffolds, students progressed from isolated lexical recognition toward structured bilingual discourse production. The results are presented through integrated quantitative and qualitative analyses to provide both statistical evidence of learning gains and explanatory insight into the learning processes underlying these gains.

2.1. Integrating Bilingual Literacy through Thematic Instruction

The study employed a quasi-experimental design involving an experimental group (ILDA-based instruction) and a control group (traditional textbook-based bilingual instruction). Students were assigned to groups based on existing classroom structures to preserve ecological validity. Prior to the intervention, baseline testing confirmed no statistically significant differences between groups across the measured literacy indicators ($p > 0.05$).

The experimental group received instruction using ILDA principles, including:

- Thematic vocabulary maps;
- Visual grammar algorithms;
- Bloom's Taxonomy-based cognitive progression;
- Genre-based literacy tasks informed by systemic functional linguistics.

The control group followed the standard bilingual curriculum emphasizing vocabulary memorization, translation exercises, and isolated grammar practice.

After the intervention period, the experimental group demonstrated substantially higher performance gains across all bilingual literacy indicators compared to the control group, suggesting that structured visual-metacognitive scaffolding played a central role in accelerating bilingual literacy development in an artificial bilingual context.

2.2. Interpretation of Statistical Results

(1) Data Sources and Collection Procedures

Quantitative data were obtained from standardized pre- and post-intervention bilingual literacy assessments administered under controlled classroom conditions. The assessments included:

- Vocabulary classification tasks;
- Sentence construction tasks;
- Comparative grammar tasks;
- Bilingual concept map completion tasks.

Each task was scored using analytic rubrics validated through pilot testing with a comparable student cohort. Reliability testing yielded a Cronbach's alpha of 0.87, indicating strong internal consistency.

(2) Statistical Processing

To ensure analytical rigor, the study employed multiple statistical indicators (**Table 1**):

- **Fisher's φ-Criterion**
  Used to determine statistical significance between pre- and post-intervention proportions. Values exceeding the critical threshold (ϕcrit = 2.31) indicate statistically significant improvement.
- **Confidence Intervals (95%)**
  Calculated using standard proportion difference formulas to estimate the likely range of improvement across the population.
- **Effect Size (Cohen's *h*)**
  Calculated using:

$$h = 2(\arcsin(\sqrt{p_2})) - 2(\arcsin(\sqrt{p_1}))$$

Effect size interpretation:

- 0.20 = small;
- 0.50 = medium;
- 0.80+ = large.

Table 1. Statistical Progress and Effect Sizes.

Criteria	Pre (%)	Post (%)	Fisher φ	95% CI	Cohen's *h*
Vocabulary Classification	46.7	90.0	3.82*	[32%, 55%]	1.02 (Large)

Table 1. *Cont.*

Criteria	Pre (%)	Post (%)	Fisher φ	95% CI	Cohen's *h*
Sentence Construction	40.0	86.7	3.94*	[35%, 62%]	1.05 (Large)
Comparative Adjectives	26.7	80.0	4.31*	[41%, 65%]	1.13 (Large)
Bilingual Map Completion	33.3	83.3	4.12*	[38%, 62%]	1.07 (Large)

Note: * Significant at $p < 0.01$.

The large effect sizes across all indicators indicate that ILDA produced not only statistically significant but also practically meaningful educational improvements.

(3) Addressing Possible Confounds

Potential confounding variables were considered, including:

- Natural cognitive maturation;
- External English exposure;
- Teacher influence.

However:

- 75% of participants reported no English exposure outside school.
- The grammatical structures acquired (e.g., fixed English adjective-noun order) are unlikely to emerge through passive exposure alone.
- Teachers followed standardized ILDA implementation protocols.
- These factors strengthen the attribution of observed gains to ILDA-based instruction.

2.3. Qualitative Analysis and Participant Perspectives

(1) Qualitative Data Sources

Qualitative data were collected through:

- Semi-structured student interviews (n = 18), representing a purposive subset of the total participant sample (N = 30). Students were selected to reflect varying levels of bilingual proficiency, classroom participation, and communicative confidence observed during instructional activities.
- Teacher reflective journals (weekly entries).
- Classroom observations (bi-weekly structured observation protocol).

(2) Instrument Development and Validation

Interview questions were developed based on:

- Metacognitive awareness frameworks;
- Bilingual literacy development models.

Content validity was established through expert review by three bilingual education specialists. Pilot interviews were conducted to refine question clarity and age appropriateness.

(3) Data Analysis Procedures

Thematic analysis followed a multi-stage process:

1. Open coding (initial concept identification);
2. Axial coding (theme grouping);
3. Selective coding (core theme integration).

To enhance methodological rigor:

- **Triangulation:** Cross-checking across interviews, observations, and teacher journals;
- **Inter-rater reliability:** Two independent coders analyzed 30% of data; agreement rate = 91%;
- **Audit trail:** Coding decisions documented systematically.

(4) Emerging Qualitative Themes

- **Visual Scaffolds as Cognitive Anchors**
  Students increasingly relied on visual grammar and thematic maps as internalized cognitive organizers.

Teacher quote:

"The grammar ruler became a reference point students returned to independently. They began self-correcting before teacher feedback."

Student quote:

"When I speak English, I see the map in my head and follow it."

- **Growth of Metalinguistic Awareness**
  Students demonstrated increasing awareness of cross-linguistic differences.

  Teacher quote:

  "Students began explaining grammar differences between Ukrainian and English without prompting."

  Student quote:

  "In Ukrainian I can move words, but in English I must follow the line."

- **Increased Communicative Confidence**
  Students showed reduced anxiety and greater willingness to produce extended utterances.

  Observation note:

  Students initiated bilingual explanations during group tasks without teacher prompting.

(5) Integration of Quantitative and Qualitative Findings

Qualitative findings directly support statistical outcomes. For example:

- Large gains in sentence construction correspond with increased student references to visual grammar scaffolds.
- Vocabulary classification gains align with student reliance on thematic mapping strategies.
- Bilingual map completion improvements correspond with observed metacognitive planning behaviors.

2.4. Limitations and Generalizability

Despite strong results, several limitations must be acknowledged:

- **Sample Constraints**
  Single-school context may limit generalizability.
- **Teacher Implementation Variability**
  Despite training, micro-level instructional differences may have influenced outcomes.
- **Novelty Effect**
  Initial motivation may partially reflect exposure to innovative methodology.
- **Artificial Bilingual Context**
  Results may differ in natural bilingual immersion environments.

Future research should include:

- Multi-site replication;
- Longitudinal tracking;
- Cross-cultural implementation comparisons.

3. Discussion

The findings of this study provide strong evidence that the Integrated Literacy Development Approach (ILDA) effectively supports the transition from emergent to functional literacy in artificial bilingual settings. By grounding language acquisition in Flavell's [6] metacognitive framework and Vygotsky's sociocultural theory [19, 21, 22], the intervention provided students with the "semiotic tools" necessary to navigate three distinct linguistic systems (Russian, Ukrainian, and English).

(1) Critical Reflection and Pedagogical Challenges

Despite the quantitative success of the intervention, the qualitative observations revealed several challenges that merit critical reflection:

- **Scaffold Dependency:** A primary concern identified during the second semester was the potential for over-reliance on visual scaffolds. While the "grammar ruler" and concept maps were essential for initial sentence production, some learners struggled when transitioned to text-only tasks. One teacher observed, *"A small group of students became 'locked' into the visual icons; without the physical arrow symbol, their ability to retrieve the verb 'is' dropped significantly."* This suggests that while scaffolds are vital for entry, the "fading" process (gradual removal of support) must be more systematically managed to ensure long-term linguistic autonomy.
- **Cognitive Fatigue:** The repetitive nature of the thematic format, while beneficial for reinforcement, led to occasional "thematic fatigue." In the later stages of the "Food and Meals" unit, engagement levels dipped among high-achieving students who had already mas-

tered the core vocabulary. This highlights the need for differentiated instruction within the ILDA framework to keep advanced learners challenged while supporting those who still require the maps.

- **Processing Speed vs. Accuracy:** The use of metacognitive schemes naturally slows down the speech production process as students "plan" their sentences using the visual logic. While this significantly increased accuracy, it occasionally hindered fluency. Future iterations of the approach should include transition phases that move from deliberate, schema-based construction to rapid, automatized speech.

(2) Contextual Limitations and Generalizability

A key question for this study is whether these results can be generalized to other educational contexts.

- **The "Linguistic Island" Context:** The success of ILDA at the Interclass Bilingual Primary School is deeply tied to the specific condition of artificial bilingualism. In environments where the target language (English) is not supported by the local community, the "visual anchor" provided by ILDA acts as a necessary substitute for natural immersion. Therefore, these findings are highly applicable to schools in Eastern Europe, Central Asia, or East Asia where students face similar L1/L2/L3 dynamics.
- **Scalability:** The reliance on teacher training and standardized visual materials suggests that while the model is scalable, its success depends heavily on implementation fidelity. Without specific training in metacognitive instruction, teachers may use the maps as mere vocabulary posters rather than active thinking tools.
- **Age Specificity:** While highly effective for Grade 1 learners (ages 6–7) due to their developmental stage (transitioning from pre-operational to concrete operational thought), the heavy use of pictorial scaffolds may need to be adapted into more abstract, symbol-based schemes for older primary students.

(3) Conclusion and Future Research

The study concludes that integrating bilingual literacy through thematic instruction and metacognitive scaffolding is a powerful antidote to the cognitive fragmentation often found in bilingual education. By making the "hidden" rules of language visible, ILDA empowers students to become active participants in their own learning. Future research should focus on the long-term retention of these metacognitive strategies as students move into the upper primary years and encounter more abstract academic content. Specifically, longitudinal studies are needed to determine if the "metalinguistic bridge" built in Grade 1 sustains literacy development across higher levels of the Common European Framework of Reference for Languages (CEFR).

(4) Implications for Educational Practice and Policy

The success of the Integrated Literacy Development Approach (ILDA) at the primary level suggests several critical shifts for both classroom practice and broader educational policy, particularly in regions navigating complex multilingualism.

(5) Teacher Training and Professional Development

The study highlights that the effectiveness of metacognitive tools is highly dependent on the teacher's ability to facilitate "thinking about language."

- **Core Curricular Modules:** It is recommended that teacher development programs for bilingual educators embed bilingual concept mapping and metacognitive scaffolding as core modules. Training should move beyond general methodology to focus on the technical construction of parallel linguistic schemes.
- **Shift in Role:** Educators must be trained to act as "cognitive architects" who do not just deliver content but design the visual frameworks that allow students to categorize and retrieve information across different languages.

(6) Curriculum Integration and Policy

For ministries of education and school boards, the study supports a move toward Thematic-Linguistic Integration.

- **Unified Literacy Standards:** Rather than treating L2 (national language) and L3 (foreign language) as separate silos with different curricula, policy should encourage a unified thematic schedule. This allows for the "Common Underlying Proficiency"[2, 23, 24] to be

activated, as students engage with the same concepts (e.g., "Ecology" or "Transport") across all language blocks.

- **Resource Allocation:** Policy should prioritize the development of bilingual and multimodal instructional materials over monolingual textbooks, recognizing that "artificial bilingualism" requires unique visual support systems.

(7) Digital Evolution: From Physical to Virtual Scaffolds

As classrooms become increasingly digitized[25], the transition from physical "grammar rulers" and paper maps to digital platforms offers significant opportunities for enhancement:

- **Interactive Concept Mapping:** Digital tools (such as Cmap or specialized educational apps) can allow students to "drag and drop" vocabulary into parallel structures. This adds a layer of gamification and allows for instant feedback—for instance, a digital "grammar ruler" could glow red if a student places an adjective in a position that violates the target language's syntax.
- **Adaptive Learning:** Digital versions of ILDA scaffolds can be programmed to "fade" automatically. As the software detects a student's increasing proficiency and speed in sentence construction, it can gradually reduce the prominence of visual icons, transitioning the learner toward abstract text-only tasks.
- **Multimodal Richness:** Digital platforms can integrate audio files directly into the concept maps. By clicking a node on a map, a student can hear the pronunciation in both Ukrainian and English, further strengthening the phonological link between the two languages.

(8) Global Applicability

While developed in a Ukrainian context, the implications of ILDA extend to any "linguistic island" environment. Whether in a rural school in Asia or an immigrant-heavy district in Western Europe, the principle of using visual, metacognitive anchors to bridge the gap between home and school languages remains a vital strategy for fostering equitable literacy development.

4. Conclusions

The study at Interclass Bilingual Primary School underscores that bilingual literacy in an "artificial" environment is most effectively developed when language is treated as a cognitive tool rather than a set of memorized facts. By implementing the Integrated Literacy Development Approach (ILDA), this research has demonstrated that thematic continuity, paired with metacognitive scaffolding, provides emergent learners with a stable framework for navigating multiple linguistic systems simultaneously.

While the quantitative gains in vocabulary and sentence structure were significant, the more profound outcome was the development of metalinguistic awareness. The use of "grammar rulers" and parallel concept maps allowed students to visualize the structural differences between Ukrainian and English, effectively "pre-empting" common cross-linguistic interference. This shift from intuitive to regulated language production is essential for students in "linguistic island" contexts, where natural immersion is unavailable.

Future Research and Directions

As bilingual education continues to evolve in a globalized digital landscape, the findings of this study open several avenues for future inquiry:

- **Longitudinal Sustainability:** Future research should track these participants into the middle-school years to determine if the early foundation of metacognitive scaffolding leads to higher proficiency in academic English (CALP) compared to peers taught through traditional communicative methods.
- **Thematic Expansion:** While "Transport" and "Food" served as effective entry points, exploring ILDA's efficacy across more abstract thematic domains—such as "Social Justice," "Environmental Science," or "Digital Citizenship"—would test the approach's versatility for older age groups.
- **Technological Integration:** There is a clear need to investigate how these physical metacognitive schemes can be translated into adaptive digital platforms. Research into AI-driven concept maps that "fade" their support based on real-time learner performance could

revolutionize individualized bilingual instruction.

- **Cross-Contextual Validation:** Applying the ILDA framework to different language pairs (e.g., Spanish-English or Mandarin-English) would help determine if the benefits of visual scaffolding are universal or contingent on the specific syntactic distances between the languages involved in this study.

Ultimately, this study advocates for a pedagogical shift that honors the learner's existing linguistic repertoire. By making the "hidden" logic of language visible through multimodal and thematic instruction, educators can ensure that bilingualism remains a cognitive asset rather than an academic burden.

Author Contributions

Conceptualization, N.T. and M.T.; methodology, N.T. and M.T.; validation, N.T. and M.T.; formal analysis, N.T. and M.T.; investigation, M.T.; resources, M.T.; data curation, M.T.; writing—original draft preparation, M.T.; writing—review and editing, N.T. and M.T.; visualization, M.T.; supervision, N.T.; project administration, M.T. Both authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Institutional Review Board Statement

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical review and approval were waived for this study because it involved normal educational practices, classroom observations, interviews, and analysis of anonymized student learning outcomes without any medical intervention or collection of sensitive personal data.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. Written parental consent was obtained for all participating students, and participation was voluntary.

Data Availability Statement

The data presented in this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy and ethical considerations involving minor participants.

Conflicts of Interest

The authors declare no conflict of interest.

AI Use Statement

The authors utilized the large language model Gemini (developed by Google) during the revision process of this manuscript. The AI tool was employed to assist with academic copyediting, improving the clarity and flow of the text, expanding the abstract to meet word count requirements, and ensuring the manuscript consistently addressed specific structural feedback provided by peer reviewers. The authors have reviewed, edited, and validated all AI-generated suggestions. The authors take full responsibility for the accuracy, integrity, and originality of the final manuscript, including the validity of the data and the theoretical interpretations presented.

References

[1] August, D., Shanahan, T., Escamilla, K., 2009. English Language Learners: Developing Literacy in Second-Language Learners—Report of the National Literacy Panel on Language-Minority Children and Youth. Journal of Literacy Research. 41(4), 432–452.

[2] Cummins, J., 2000. Language, Power, and Pedagogy: Bilingual Children in the Crossfire. Multilingual Matters: Clevedon, UK. DOI: https://doi.org/10.21832/9781853596773

[3] Garrity, S.M., Aquino-Sterling, C.R., Salcedo-Potter, N., 2019. Head Start Educators' Beliefs About Bilingualism, Dual Language Development, and Bilingual Education. Bilingual Research Journal. 42(3), 308–323. DOI: https://doi.org/10.1080/15235882.2019.1624282

[4] Cummins, J., 2007. Rethinking Monolingual Instructional Strategies in Multilingual Classrooms. Canadian Journal of Applied Linguistics. 10(2), 221–240.

[5] Bialystok, E., 2018. Bilingual Education and the Development of Metalinguistic Awareness. Annual Review of Applied Linguistics. 38, 3–15.

[6] Flavell, J.H., 1979. Metacognition and Cognitive Mon-

itoring: A New Area of Cognitive-Developmental Inquiry. American Psychologist. 34(10), 906–911. DOI: https://doi.org/10.1037/0003-066X.34.10.906

[7] Novak, J.D., Cañas, A.J., 2008. The Theory Underlying Concept Maps and How to Construct Them. Florida Institute for Human and Machine Cognition: Pensacola, FL, USA.

[8] Tokareva, N., Tsehelska, M., 2025. Metacognitive Scaffolding for Foreign Language Fluency: Algorithmic and Integrated Learning Schemes. Language Exploration. 1(1), 3193.

[9] Tokareva, N., Tsehelska, M., Ilienko, O., et al., 2025. Projective-Recursive Technology as a Predictor of Efficiency in English Language Teaching. In: Morhunova, N., Levchenko, I., Kholodov, A., et al. (Eds.). Implementation of Modern Technologies in Language Learning as a Basis for the Formation of Communicative Competences: Monograph. Technology Center PC: Kharkiv, Ukraine. pp. 154–170. DOI: https://doi.org/10.15587/978-617-8360-15-3.ch10

[10] Tokareva, N., Tsehelska, M., 2023. Variability of the Linguistic Consciousness Development of an Individual in the Artificial Bilingualism Conditions. Psycholinguistics. 33(2), 196–216. DOI: https://doi.org/10.31470/2309-1797-2023-33-2-196-216

[11] Cahyati, S.S., Parmawati, A., Atmawidjaja, N.S., 2019. Optimizing English Teaching and Learning Process to Young Learners (A Case Study in Cimahi). Journal of Educational Experts. 2(2), 107–114.

[12] Frigolé, N., Tresserras, E., 2023. Teaching English as a Foreign Language in Multilingual Milieus in Catalonia: Perspectives and Practices of Educators in Three State Schools. International Journal of Bilingual Education and Bilingualism. 26(2), 230–243. DOI: https://doi.org/10.1080/13670050.2022.2114786

[13] García, O., Wei, L., 2014. Translanguaging: Language, Bilingualism, and Education. Palgrave Pivot: London, UK.

[14] Giguere, D., Hoff, E., 2023. Bilingual children's vocabulary skills at 5 years predict reading comprehension development within, not across, languages. International Journal of Bilingual Education and Bilingualism. 27(2), 240–252. DOI: https://doi.org/10.1080/13670050.2023.2166397

[15] Persici, V., Majorano, M., Bastianello, T., et al., 2022. Vocabulary and Reading Speed in the Majority Language Are Affected by Maternal Language Proficiency and Language Exposure at Home: A Study of Language Minority Bilingual Children in Italy. International Journal of Bilingual Education and Bilingualism. 25(10), 3729–3744. DOI: https://doi.org/10.1080/13670050.2022.2076552

[16] Marks, R.A., Sun, X., McAlister López, E., et al., 2022. Cross-Linguistic Differences in the Associations between Morphological Awareness and Reading in Spanish and English in Young Simultaneous Bilinguals. International Journal of Bilingual Education and Bilingualism. 25(10), 3907–3923. DOI: https://doi.org/10.1080/13670050.2022.2090226

[17] Garton, S., Copland, F., 2018. The Routledge Handbook of Teaching English to Young Learners. Routledge: London, UK. DOI: https://doi.org/10.4324/9781315623672

[18] Shymko, V., 2021. Discourseology of Linguistic Consciousness: Neural Network Modeling of Some Structural and Semantic Relationships. Psycholinguistics. 29(1), 193–207. DOI: https://doi.org/10.31470/2309-1797-2021-29-1-193-207

[19] Vygotsky, L.S., 1978. Mind in Society: The Development of Higher Psychological Processes. Cole, M., John-Steiner, V., Scribner, S., et al. (Eds.). Harvard University Press: Cambridge, MA, USA.

[20] Gort, M., Pontier, R.W., 2013. Exploring Bilingual Pedagogies in Dual Language Preschool Classrooms. Language and Education. 27(3), 223–245. DOI: https://doi.org/10.1080/09500782.2012.697468

[21] Nikolov, M., 2009. Early Learning of Modern Foreign Languages: Processes and Outcomes. Multilingual Matters: Bristol, UK.

[22] Yavorska, H.M., 2000. Prescriptive Linguistics as a Discourse: Language, Culture, Power. National Academy of Sciences of Ukraine, O.O. Potebnia Institute of Linguistics: Kyiv, Ukraine. (in Ukrainian)

[23] Kress, G., van Leeuwen, T., 2001. Multimodal Discourse: The Modes and Media of Contemporary Communication. Arnold Publishers: London, UK.

[24] Derewianka, B., Jones, P., 2023. Teaching Language in Context. Oxford University Press: Oxford, UK.

[25] Makaruk, L.L., 2021. Multimodal Linguistics and Its Metalanguage. In: Areshenkova-Levchenko, O.Y. (Ed.). Philological Science and Education: Transformation and Development Vectors. Baltija Publishing: Riga, Latvia. pp. 304–339. DOI: https://doi.org/10.30525/978-9934-26-083-4-16 (in Ukrainian)