

Designing Narrative-Based CLIL for an LCTL Classroom: A Greek Immersion Unit from Chlorophyll to Comics

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Abstract

Greek is a Less Commonly Taught Language (LCTL) for which proficiency-oriented materials for elementary immersion remain scarce. This article presents a design-based instructional proposal — not an empirical study — for a narrative-based Content and Language Integrated Learning (CLIL) unit for learners aged 8–11, anchored in the autumn science of leaf pigments and grounded from its opening activity in Greek landscape, flora, and vocabulary. Structured around the 5E Inquiry Model and aligned to the ACTFL World-Readiness Standards, the unit moves through a comic provocation, a televised interview, song, cause-and-effect tasks, and a culminating comic-and-role-play performance, with explicit content and language outcomes. The article demonstrates how CLIL, inquiry-based learning, multimodality, and narrative pedagogy can be systematically integrated into a single unit, proposes three transferable design principles for other LCTL contexts, and identifies priorities for future empirical implementation.

Keywords: *Modern Greek; less commonly taught languages; Content and Language Integrated Learning; elementary immersion; 5E instructional model; multiliteracies; ACTFL World-Readiness Standards*

1.1 The Challenge and the Purpose of the Project

Greek occupies a particular position in the Less Commonly Taught Languages (LCTL) landscape in North America. While the language is supported by an established community-school tradition, materials specifically designed for elementary immersion programs serving young learners ages 8–11 with mixed heritage and non-heritage backgrounds remain limited (Brown, 2009; Walker & McGinnis, 2005).

This gap creates a recurring challenge: how can elementary Greek immersion be made content-rich, communication-driven, and developmentally appropriate for late-elementary learners at the same time? Children at this age are capable of meaningful disciplinary thinking and benefit from learning experiences that engage multiple modalities (Cope & Kalantzis, 2009; Tedick & Fortune, 2013), yet they require scaffolding that adult-oriented or grammar-driven curricula seldom supply.

The purpose of this article is to present the design of an instructional unit developed in response to this gap. The unit integrates four pedagogical approaches — Content and Language Integrated Learning (CLIL), inquiry-based learning organized by the 5E science instructional model (Bybee et al., 2006), multimodal interdisciplinary learning, and narrative-based teaching with dramatization and comics creation — around a single content anchor: the autumn

science of leaf change and photosynthesis. These approaches were chosen because, taken together, they reframe elementary Greek as a medium for inquiry and meaning making rather than as a grammatical object; they give language use a disciplinary purpose; and they offer young learners several modal entry points into a single conceptual core. The unit has not yet been empirically implemented; this article presents its rationale and architecture and identifies areas where future empirical study is needed.

Although the unit is anchored in a scientific phenomenon rather than an explicitly cultural topic, it is deliberately situated within the Greek cultural and environmental context through its use of the Greek autumn landscape, native tree species, and Greek-derived scientific terminology. As a result, culture is embedded in the instructional design from the outset rather than introduced as a supplementary element.

2. Pedagogical Framework

2.1 Content and Language Integrated Learning (CLIL)

CLIL is a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language (Coyle, Hood, & Marsh, 2010). Coyle's "4 Cs" framework — Content, Communication, Cognition, and Culture — provides a structure for integrating

these elements: learners engage with subject matter (Content) through use of the target language (Communication), develop the thinking skills appropriate to that subject matter (Cognition), and build awareness of how language and content connect culturally (Culture) (Coyle, 2007).

A central principle of CLIL theory concerns the distinction between Basic Interpersonal Communication Skills (BICS) — the everyday language used to participate in classroom interaction — and Cognitive Academic Language Proficiency (CALP) — the discipline-specific language required to engage with subject-matter content (Cummins, 2000). CLIL units must therefore address two distinct vocabulary registers: a basic interpersonal layer that supports classroom talk, and an academic layer that carries the discipline. The present unit implemented this distinction explicitly. Its basic interpersonal vocabulary includes color terms (πράσινο, κίτρινο, κόκκινο, πορτοκαλί, καφέ — green, yellow, red, orange, brown), seasonal terms (καλοκαίρι, φθινόπωρο, άνοιξη — summer, autumn, spring), and common verbs (αλλάζω, βλέπω, δίνω — change, see, give). Its academic vocabulary consists of the Greek-origin scientific terms — χλωροφύλλη (chlorophyll), ξανθοφύλλη (xanthophyll), καροτίνη (carotene), ανθοκυανίνη (anthocyanin), τανίνη (tannin), and φωτοσύνθεση (photosynthesis) — that students will continue to encounter throughout their later science

education. Both registers are deliberately scaffolded across the unit, so that learners gain interpersonal fluency while also acquiring the disciplinary lexis that elementary CLIL is meant to build.

Research on CLIL across European and North American contexts indicates that well-designed CLIL units can yield gains in both content learning and language proficiency, especially when teachers explicitly attend to language scaffolding alongside content goals (Dalton-Puffer, 2011; Lyster, 2007). For elementary learners, CLIL also counteracts the abstraction of stand-alone vocabulary lessons by anchoring language use in concrete, observable phenomena.

2.2 Inquiry-Based Learning and the 5E Instructional Model

Inquiry-based learning is rooted in the educational philosophies of Dewey (1938) and Bruner (1961), who argued that learners construct understanding most deeply through investigation rather than passive reception. Within elementary science education, the 5E instructional model — Engage, Explore, Explain, Elaborate, Evaluate (Bybee et al., 2006) — provides a widely used framework that operationalizes inquiry as a sequence of phases: an initial provocation that engages curiosity, an exploration of the phenomenon, the formal

explanation of concepts and vocabulary, the elaboration of understanding into new contexts, and an evaluative demonstration of what learners have come to know. The 5E sequence proved particularly suitable for the present unit, in which each phase is realized through a narrative scaffold.

Inquiry was selected because it gives elementary language learners genuine reasons to use the target language. When students are motivated to answer a question and asked to observe, compare, predict, and explain, language becomes a tool for thinking rather than a curricular endpoint. Meta-analyses also indicate that inquiry-based approaches can be effective for young learners when adequate scaffolding is provided (Hmelo-Silver, Duncan, & Chinn, 2007) — a condition that the multimodal and narrative supports described below help to satisfy.

2.3 Multimodal Interdisciplinary Learning

Multimodal learning extends literacy beyond written and oral language to include visual, gestural, spatial, and tactile modes (Cope & Kalantzis, 2009; Kress, 2010; New London Group, 1996). The multiliteracies framework asserts that contemporary communication is inherently multimodal and that schools must therefore prepare learners to interpret and produce meaning across modes.

Multimodal interdisciplinary design was chosen for three reasons. First, it provides multiple entry points to a concept, reducing the load on any single modality — especially target-language vocabulary, which is a real constraint for young LCTL learners. Second, it allows interdisciplinary content such as plant biology to be authentically explored in Greek. Third, it engages young learners’ natural inclination toward drawing, gesture, singing, and embodied expression as meaning-making resources.

2.4 Narrative-Based Teaching, Dramatization, and Comics Creation

A distinguishing feature of the unit is its use of narrative as the primary instructional scaffold. Egan (1989) argued that story is one of the most powerful tools young learners possess for making sense of new ideas: when scientific content is told as a story, with characters, conflict and a resolution, children use their natural sense of how stories work to understand the science. In the present unit, the scientific phenomenon is introduced through a comic-style narrative crisis and explained through a televised news interview in which the central concept — chlorophyll — is personified as a character (referred to in the materials as Ms. Chlorophyll, κυρία Χλωροφύλλη).

Narrative reception is then balanced by narrative production. Dramatization, including total physical response (Asher, 1969), role play, and personification, supports embodied conceptual understanding and lowers the affective filter for young learners. Lyster (2007) argues that such counterbalanced instruction is particularly productive in content-driven L2 classrooms. Creating comics combines visual and verbal modes within a structured frame that supports sequencing, dialogue, and voice. Cohn (2013) describes comics as having a 'visual language' with its own grammatical rules; for young L2 learners, the comic frame supports production by offering a familiar storytelling structure while asking students to bring image and text together. The unit also includes a song to help consolidate target vocabulary, drawing on the well-documented role of music in supporting L2 retention and engagement (Murphey, 1992).

3. The Project: Why Do the Trees Change Color?

3.1 Content Overview

The unit takes as its content anchor the seasonal transformation of leaf color. During the growing season, leaves appear green because chlorophyll — the pigment essential to photosynthesis — masks the other pigments present in the leaf. As days shorten in autumn, chlorophyll

production decreases, revealing the yellow xanthophylls and orange carotenes already present, while red and purple anthocyanins are sometimes newly produced; tannins eventually turn the leaves brown. Photosynthesis (φωτοσύνθεση) itself is presented as the process by which sunlight, water, and air give plants energy and food.

For elementary learners, this content provides a striking, observable phenomenon they can witness directly during the autumn weeks of the unit. It also provides a rich Greek-derived scientific vocabulary: χλωροφύλλη (chlorophyll, from χλωρός “green” + φύλλο “leaf”), ξανθοφύλλη (xanthophyll, from ξανθός “yellow”), καροτίνη (carotene), ανθοκυανίνη (anthocyanin), ταννίνη (tannin), and φωτοσύνθεση (photosynthesis, from φως “light” + σύνθεση “synthesis”). The phenomenon is thus simultaneously a science topic and a language topic.

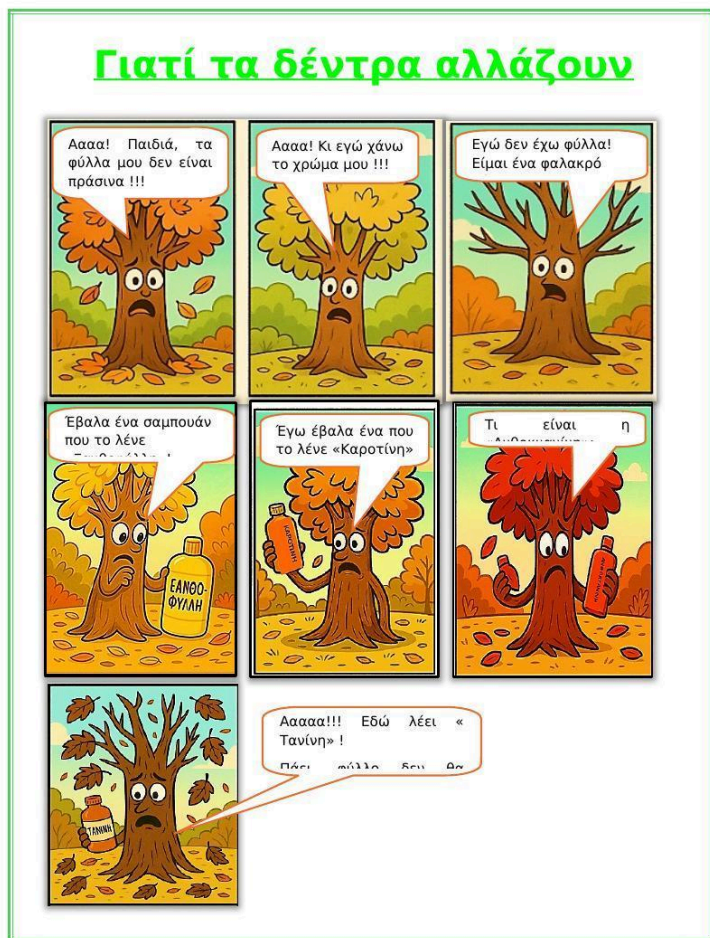
3.2 Narrative Architecture

The unit opens with a visual investigation of Greek autumn. Students view a photograph of a Greek autumn landscape and are invited to describe what they see in Greek, naming the trees they recognize and the colors of the leaves. The photograph deliberately includes both deciduous Greek trees — chestnut, oak, plane tree, fig tree — and Greek evergreens —olive tree, pine tree, cypress, laurel. Students notice the

contrast: some trees retain their green leaves while others have changed color and shed some of theirs. Group discussion turns to hypothesis: “Why do some trees stay green while others lose their leaves?”. This opening sets the unit in Greek place and flora and lets students observe and hypothesize about the phenomenon before any formal explanation is offered.

The investigation then becomes a story. On Page 1 of the materials, a row of comic-style trees with expressive faces panic that they are losing their colors and leaves; they hold labeled “shampoo” bottles bearing the names of unfamiliar pigments — Xanthophyll, Carotene, Anthocyanin, Tannin — as the source of the trouble. This visual hook (Figure 1) dramatizes in child-friendly form the question students have begun to discuss.

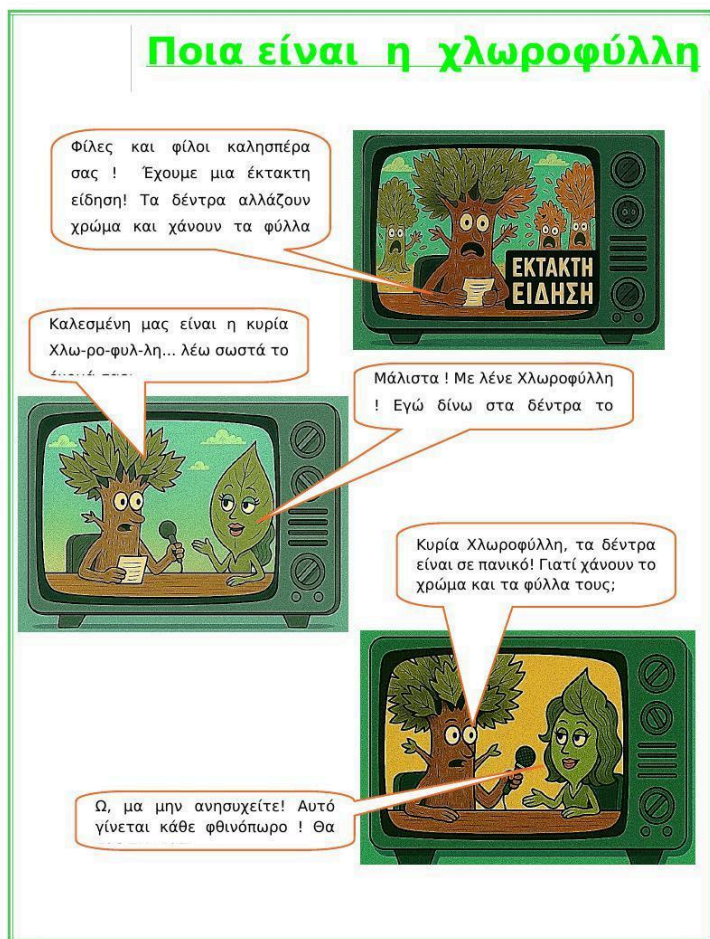
Figure 1. Page 1 of the materials: panicking trees with “pigment shampoos.” The comic dramatizes the question that the opening observation activity is designed to raise.



The investigation arrives in the form of a televised news bulletin. On the next pages, a tree-reporter announces breaking news, interviews a personified leaf-figure introduced as Ms. Chlorophyll, and elicits her explanation of why leaves

change color: in summer, long days and abundant sunlight allow her to remain in the leaves and enable photosynthesis; in autumn, shorter days and reduced light cause her to depart, revealing the other pigments. The interview format (Figure 2) delivers scientific content in Greek through reciprocal dialogue, modeling both question-and-answer discourse and the lexis of the topic.

Figure 2. Content delivery via narrative scaffold: a televised interview with Ms. Chlorophyll on “breaking news.”



From this narrative entry point, the unit moves through a sequence of activities that recycles the content across modes: a matching activity that introduces the other pigments through illustrated leaf-characters, a song that rhymes the pigments and their colors, cause-and-effect

sentence chains that build scientific reasoning in Greek, a synthesis cloze paragraph, a drawing-and-writing comparison of summer and autumn, and a culminating collaborative task in which students produce their own comics about the changing trees and act them out for the class.

3.3 The 5E Inquiry Arc Operationalized

Each phase of the 5E model (Bybee et al., 2006) is operationalized through a specific activity or sequence within the unit.

Engage and Explore (Opening activity). The unit's opening photograph of a Greek autumn landscape serves both phases simultaneously. The visual richness and cultural specificity of the image hook student attention (Engage), while the descriptive and hypothesizing discussion that follows constitutes genuine exploration. The students observe the phenomenon directly, classify the trees into those that retain their green leaves and those that change color and lose them, and propose hypotheses about why this difference exists — all before any formal explanation is given. Beginning with student observation and hypothesis-generation, rather than with content delivery, aligns the unit with the spirit of inquiry-based science instruction.

Engage: The comic-style scene of panicking trees provides a second, dramatic restatement of the central

question, sustaining motivation as the unit moves toward the explanatory phase.

Explain: The television interview format (Pages 2–4) delivers the scientific explanation through narrative dialogue: students follow the conversation between the tree-reporter and Ms. Chlorophyll, encountering core vocabulary in context. A set of discussion questions on Page 4 invites learners to consolidate what they have heard: “What happens in nature in autumn? Why do leaves change color?”. Then, “The friends of chlorophyll” matching activity introduces Xanthophyll, Carotene, Anthocyanin, and Tannin as personified pigment-characters and asks students to pair each pigment with its color and write sentences modeled on a given example. The song “Chlorophyll” formalizes the same pigment-and-color information in rhyming, memorable form. Together, the interview, the matching activity, and the song serve the Explain function: they formally introduce and consolidate the unit’s academic vocabulary through three complementary modalities — narrative, visual matching, and song.

Elaborate: A cause-and-effect chain task asks students to connect day length to light, light to chlorophyll, and chlorophyll to green leaves using the structure Όταν... (“When...”), extending the pigment vocabulary into causal reasoning. A cloze paragraph then requires students to select

from a bank of target words (photosynthesis, chlorophyll, light, energy, soil, small, color) to complete the scientific account in connected prose. Finally, a drawing-and-writing task asks students to depict and then explain in writing the contrast between long summer days and short autumn days. Across these three tasks the concepts established in the Explain phase are applied in new representational forms — sentence-level reasoning, paragraph-level synthesis, and personal explanation.

Evaluation: Formative checkpoints are embedded throughout the earlier phases: the matching-activity sentences, the cause-and-effect chains, and the cloze paragraph each let the teacher observe vocabulary and reasoning informally as students' progress through the unit. These checkpoints culminate in the unit's summative assessment: small groups produce a comic featuring trees, the sun, and Ms. Chlorophyll — using speech bubbles to give each character a voice — and then perform their comic as a short play. Unlike the earlier formative checkpoints, this culminating performance is scored using a simple two-part rubric: content accuracy (naming at least three pigments and stating one accurate cause-and-effect link between day length, light, and chlorophyll) and language use (comprehensible dialogue, use of taught sentence frames, and combined use of the interpersonal and academic vocabulary registers). Observable

indicators include correctly labeled characters, at least one causal connective (Οταν...) in the dialogue, and a comic sequence that a listener can follow without prior knowledge of the story.

3.4 The 4 Cs of CLIL in Practice

Content: Students learn the basic mechanism of photosynthesis, the five pigments involved in autumn leaf color, and the relationship among day length, light, chlorophyll, and leaf appearance.

Communication: Greek is the medium throughout, and both vocabulary registers described in Section 3.1 are activated. Basic interpersonal lexis carries classroom interaction; the academic lexis of the discipline (chlorophyll, xanthophyll, photosynthesis, and so on) carries the content. Sentence frames support observation, explanation, and cause-effect reasoning (when..., because..., so...).

Cognition: Students engage in observation, classification (the matching activity), causal reasoning, synthesis (the cloze paragraph and culminating writing task), and creative re-representation (the comics and dramatization). These thinking moves align with elementary science standards as well as with language learning.

Culture: The Culture goal area is realized from the very opening of the unit. Before any scientific content is introduced, students view a photograph of a Greek autumn landscape and learn the Greek names of the trees they see—both the deciduous Greek trees that change color and shed their leaves and the Greek evergreens that remain green throughout the year. The contrast between the two groups becomes the entry point to the scientific question. These opening positions the science within a specifically Greek geographical and botanical context, so that the cultural dimension is foundational to the unit rather than supplementary. The cultural framing is then deepened in the successor sub-unit (“Grandfather’s Garden”), where these same trees reappear in a Greek family garden alongside the chrysanthemum (the autumn flower of Greece), the apple, chestnut, and grape harvests, and the foods associated with the Greek autumn table.

3.5 The Multimodal Dimension

The unit deliberately distributes the conceptual content across modes. The visual mode carries weight in the opening comic, the illustrated TV interview, the leaf-character matching, and the colored leaf photographs. The oral and aural mode is activated through the song, classroom discussion of the interview, and the final dramatization. The

written mode appears in the sentence frames, the cause-and-effect chains, the cloze paragraph, the explanatory paragraph, and the speech bubbles in students' own comics. The gestural and embodied mode emerges in the role-play performance of the student-created comics. No single modality bears the burden of the new content, and learners with different modal strengths find multiple entry points.

3.6 Target Learning Outcomes

As part of the content goals, students should be able to explain, in Greek and at an age-appropriate level of detail, why leaves change color in autumn: that chlorophyll masks other pigments during the growing season, that its decline in autumn reveals the yellow xanthophylls and orange carotenes already present, that red and purple anthocyanins are sometimes newly produced, and that tannins eventually turn leaves brown. Students should also be able to explain, in simple terms, that photosynthesis is the process by which sunlight, water, and air provide plants with the energy needed to produce their own food.

As part of the language goals, students should be able to use both the basic interpersonal vocabulary (e.g., colors, seasons, and common verbs) and the academic scientific vocabulary introduced throughout the unit (e.g., chlorophyll, xanthophyll, carotene, anthocyanin, tannin, and

photosynthesis) in connected speech and writing. Specifically, they should be able to produce cause-and-effect explanations using the 'Όταν... ("When...") structure, complete the synthesis cloze activity accurately, and create, narrate, and dramatize their own comics in Greek, demonstrating interpretive, interpersonal, and presentational communication.

4. Alignment with the ACTFL World-Readiness Standards

4.1 The Three Modes of Communication

The World-Readiness Standards for Learning Languages (National Standards Collaborative Board, 2015) organize communication into three modes: interpretive, interpersonal, and presentational. The unit implements all three through specific activities.

Interpretive communication is enacted when students interpret the opening photograph of the Greek autumn landscape, read and follow the comic provocation, follow the televised interview text, decode the illustrated pigment-character matching, and read the song. Each of these tasks requires learners to derive meaning from authentic Greek input in a multimodal format.

Interpersonal communication develops through the discussion of the opening photograph in pairs and small

groups (in which students name what they see, classify the trees, and hypothesize about the differences), through the discussion questions, through pair and small-group talk during the cause-and-effect chain task, and through the collaborative production of comics and the rehearsal of the role play. The dramatized exchange when students personify trees, sun, and Ms. Chlorophyll is itself an extended interpersonal performance.

Presentational communication culminates in two tasks. First, the drawing-and-explanation activity asks students to depict the contrast between summer and autumn and then explain it to classmates in writing and speech. Second, the group comic and role play is presented to the whole class. Earlier presentational moments include singing the chlorophyll song together and sharing individual sentences produced during the matching activity.

4.2 The Five Cs

The unit substantively addresses all five goal areas of the World-Readiness Standards: Communication, Cultures, Connections, Comparisons, and Communities.

Communication is enacted through all three modes, as described above.

Culture is realized from the opening of the unit. The first activity has students examine a photograph of a Greek

autumn landscape and learn the names of specifically Greek trees, locating the scientific question within Greek place and flora before the science itself is introduced. This makes Greek cultural context foundational rather than supplementary. This cultural framing is then deepened in a follow-up sub-unit set in a Greek family garden, where students encounter the chrysanthemum—the autumn flower of Greece—together with the harvest practices and foods of the Greek autumn.

Connections is the strongest goal area in this unit: the project explicitly connects Greek language learning with elementary science content (the biology of pigments and photosynthesis), embodying the standards' call for learners to reinforce and further their knowledge of other disciplines through the world language.

Comparisons is addressed through the etymological work that is embedded in the unit rather than treated as a separate lesson: every pigment name introduced—chlorophyll, xanthophyll, carotene, anthocyanin, tannin—is also an English scientific term, and the unit's use of the Greek originals positions the LCTL as the source language for vocabulary that the students will encounter throughout their later science education. This is a linguistic comparison—comparing how meaning is constructed in Greek and in English—rather than a cultural one.

The Communities goal area is realized when students present their comics and role plays to classmates and is further strengthened when the comics are shared with families, with the wider school, or with the Greek-speaking community served by the program. Because the culminating task itself is a public performance, the Communities goal area is built into the unit's architecture rather than appended to it.

5. Anticipated Learner Engagement and Areas for Empirical Study

The unit described above is a design-based instructional proposal that has not yet been empirically implemented. Consequently, the engagement and learning patterns discussed in this section are presented as theoretically informed predictions derived from the unit's pedagogical framework rather than as empirical findings. The section therefore outlines a research agenda for future implementation and evaluation, identifying the areas in which empirical investigation would be most informative.

Three engagement patterns are anticipated. First, the opening observation activity and the comic provocation are expected to function as strong attentional hooks for late-elementary learners. Egan's (1989) account of narrative as a primary cognitive tool for young learners, together with the willingness-to-communicate literature (MacIntyre, Clément,

Dörnyei, & Noels, 1998), predicts that task types increase learner participation when they lower communicative anxiety and provide authentic purpose.

Second, the multimodal recycling of target vocabulary—from the comic, through the interview, the matching activity, the song, and the culminating production—should support retention and transfer of the academic pigment vocabulary. This prediction follows from the multiliteracies framework’s emphasis on cross-modal meaning-making (Cope & Kalantzis, 2009; Kress, 2010) and from the documented role of music as an aid to L2 vocabulary retention (Murphey, 1992).

Third, the embedded etymological work—the deliberate use of Greek-origin scientific terms that English shares with Greek—is anticipated to support metalinguistic awareness in line with the Comparisons goal area of the ACTFL World-Readiness Standards (National Standards Collaborative Board, 2015). Whether this awareness will lead students to ask their own questions about Greek roots remains to be tested empirically.

Three areas merit prioritization in future empirical implementation. The first is pre- and post-unit performance assessment of conceptual and linguistic gains, aligned with the ACTFL proficiency framework. The second is discourse analysis of student artifacts—comics, recorded role plays,

written paragraphs—for evidence of disciplinary content uptake and of integration between the basic interpersonal and the cognitive academic vocabulary registers discussed in Section 3.1 (Cummins, 2000). The third is systematic documentation of learner engagement across the unit's phases, with particular attention to the contrast between narrative-based phases (Engage, Explore, the TV interview Explain) and the more discrete-task phases (the cloze paragraph, the cause-and-effect chains). Together, these strands of inquiry would establish whether the design delivers the integrated outcomes that its theoretical foundations predict.

6. Transferability to Other LCTL and Language Classrooms

The design pattern used in this unit is not Greek-specific and may be adapted to other LCTL elementary classrooms—and, with adjustment, to commonly taught languages as well. Three principles seem most transferable.

First, open with a narrative crisis rather than with a vocabulary list. A fictional problem—panicking trees, a missing object, a confused character—creates an authentic reason for learners to seek information in the target language. Egan (1989) describes story as a primary cognitive tool for young learners; the present design exploits this principle as its

opening move. Any phenomenon that can be personified or dramatized—a weather system, a missing animal, a planet in conversation— can serve as such an entry point.

Second, deliver content through a narrative scaffold (interview, dialogue, story) before requiring students to produce language about it. The televised interview format models reciprocal dialogue situates the target vocabulary in context and offers learners a script to analyze. The same approach can be adapted to a podcast, a letter or a children's book.

Third, structure the production phase so that learners create their own narrative in the target language. The task that combines comic creation with role play in this unit allows learners to demonstrate disciplinary understanding and language use simultaneously, in a form that is observable, evaluable, and shareable with families and community. Other constrained multimodal forms—picture books, photo essays, stop-motion videos—function similarly and can be adapted to the resources of any LCTL program.

For elementary LCTL programs operating with limited curricular budgets, these strategies offer a way to build substantial content-rich units from inexpensive, locally available materials and the teacher's own subject knowledge. The natural next step is to implement the design and empirically test the predictions outlined in Section 6: pre- and

post-unit performance tasks aligned with the ACTFL proficiency framework would yield evidence of language outcomes; student artifacts (comics, recorded role plays, written paragraphs) could be analyzed for evidence of disciplinary uptake. The aim of the present article is to argue that the design pattern itself—narrative-based CLIL organized through the 5E model and realized through multimodal and dramatic activities—constitutes a promising framework worthy of systematic study in elementary LCTL contexts.

7. Conclusion

This article has presented the design of a narrative-based CLIL unit that addresses a recurring challenge in elementary Greek immersion: the scarcity of materials that integrate scientific content, communicative language use, and Greek cultural context for late-elementary learners. By organizing inquiry around the 5E instructional model and grounding the unit in the Greek autumn landscape, the design positions Greek as a medium for meaning making rather than as an isolated grammatical object. The design pattern—narrative provocation, narrative content delivery, multimodal consolidation, applicative tasks, and creative production—is not Greek-specific and offers a transferable architecture for other elementary LCTL contexts. The proposed framework

offers a transferable model for elementary LCTL curriculum design and provides a foundation for future empirical study.

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