ENHANCING IT STUDENTS' TECHNICAL VOCABULARY AND READING COMPREHENSION THROUGH CLIL

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Abstract

This article develops a CLIL-based approach to teaching technical vocabulary and reading comprehension to undergraduate IT students through authentic software documentation. A focused narrative synthesis combines research on integrated learning and vocabulary with a document-based analysis of selected Python tutorial material. The analysis yields a material-selection procedure, a sequence linking reading with technical action, and an assessment framework separating lexical knowledge, textual interpretation and practical application. The proposed sequence moves from identifying a technical question to locating relevant information, interpreting conditions, testing an example and explaining the result in English. Particular attention is given to familiar words with specialised meanings, relations between prose and code, and the danger of treating successful execution as sufficient evidence of comprehension. The article offers an illustrative lesson and a plan for evaluating retention and transfer. Its results are instructional proposals, not experimental findings. It argues that authentic documentation can support integrated learning when content accuracy is preserved, reading demands are made manageable and students must justify their technical decisions through evidence from the text.

Keywords: CLIL; technical vocabulary; reading comprehension; IT students; software documentation; authentic materials; Python.

Introduction

Software documentation presents IT students with a particular reading challenge: understanding prose must lead to a correct technical decision. Readers often move between an explanation, a code example and the condition under which an operation is appropriate. The official Python tutorial illustrates this relationship through descriptions of data structures and their operations [1].

Reading such material involves more than translating technical nouns. A student must recognise what an instruction applies to, identify a restriction and relate the example to the surrounding explanation. Words such as "item", "key", "return" and "argument" may look familiar while functioning in specialised ways. A misunderstanding of a small grammatical element can also matter: a condition, a negation or a comparison may determine whether an operation is suitable for the intended purpose.

CLIL connects disciplinary learning with language development [2]. In the present article, the disciplinary outcome is the ability to interpret and apply a limited documentation passage accurately. The language outcome concerns the lexical and grammatical resources needed to understand and explain that passage. Both outcomes must remain visible. Completing a word-matching exercise alone cannot

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demonstrate technical comprehension, while running copied code cannot demonstrate that the reader has understood the English explanation.

Nation's analysis of vocabulary coverage highlights the lexical demands of unassisted reading [3]. Its widely cited estimates should not be converted into a fixed admission threshold for reading programming documentation. Technical texts contain code, symbols and specialised terminology, and classroom reading may include substantial support. The relevant pedagogical question is which words and relationships obstruct a particular task, rather than whether a learner has reached one universal vocabulary size.

The article asks how teachers can select authentic documentation for a CLIL lesson, how reading activities can integrate technical understanding and vocabulary development, and what evidence can distinguish comprehension from copying. The intended setting is an undergraduate English course linked to introductory programming. The proposed approach can be used with short excerpts and printed examples; it does not require that every English lesson become a programming laboratory.

Literature Review

CLIL materials must serve both content and language purposes [2]. This creates a selection problem: an authentic text may be professionally relevant but linguistically inaccessible, or linguistically manageable but conceptually trivial. The present study treats selection as a task-specific judgement. A passage is suitable when its technical content is within reach, its language demands can be supported and its use can lead to an observable decision or explanation.

Nation's account of vocabulary learning provides a basis for distinguishing knowledge of a word from recognition of its written form [4]. In this article, technical vocabulary is assessed through meaning and use within a specific documentation task. A student who translates "return" correctly but cannot explain the returned value has demonstrated only part of the required knowledge. The assessment must connect the term with its role in the technical statement.

The distinction between coverage and comprehension is equally important. Vocabulary coverage research estimates how much of a text may be lexically accessible [3]. A high proportion of familiar words does not guarantee understanding of a technical process. Readers also need to follow reference, conditions and the relation between prose and examples. The proposed lesson therefore includes interpretation tasks rather than relying exclusively on vocabulary screening.

Ball, Kelly and Clegg address support for input and output in CLIL [5]. For documentation reading, the article translates this broad principle into selective glossing, visual annotation and short explanation frames. Such support should direct attention to the meaning-bearing features of a passage. It should not give away the answer to the technical question before students have examined the evidence.

The CEFR Companion Volume includes reading and mediation within its account of language activity [6]. This permits a useful shift from asking only whether students can answer comprehension questions to asking whether they can explain a technical instruction to a peer. The proposed peer explanation is a locally designed task; it is not a direct copy of a CEFR descriptor or a certification of a proficiency level.

Dalton-Puffer's review indicates the importance of distinguishing language outcomes from content outcomes in CLIL research [7]. Applied to documentation reading, that distinction requires separate evidence of term knowledge, interpretation of the passage and technical application. An aggregate test score may conceal whether a learner understood the concept but could not explain it, or produced fluent language while selecting an inappropriate operation.

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The literature supports a focused methodological inference: authentic documentation becomes useful teaching material through the relationship between text, task and evidence. Authenticity alone is not a learning mechanism. The rest of this article develops that relationship through a small set of documentation examples. The proposed sequence is intended for testing in local classrooms and should not be read as evidence that authentic materials invariably produce better outcomes than carefully written instructional texts.

Materials and Methods

The study combines a focused narrative synthesis with a qualitative instructional analysis of documentation. The scholarly and framework sources were selected purposively to address integrated learning, vocabulary, language activity and assessment. Bibliographic details and accessible source descriptions were checked against publisher or institutional pages. The review is selective rather than systematic; no database screening count, meta-analysis or comprehensive estimate of CLIL effectiveness is claimed.

The technical material is the "Data Structures" chapter of the official Python 3.13 tutorial [1], with attention to descriptions of lists and dictionaries. A version-specific documentation route is used to reduce ambiguity about the source context, although online pages can still be revised. Teachers using the lesson should retain the selected excerpt, its URL and the access date. The article does not reproduce a full tutorial or evaluate the entire Python documentation collection.

Four features guide the analysis of a passage. The first is its technical proposition: what the operation does or when it is appropriate. The second is the vocabulary needed to understand that proposition. The third is the grammatical relation carrying a condition, contrast or consequence. The fourth is the evidence a student could produce to demonstrate understanding. This procedure generates instructional categories; it does not involve statistical coding or measured inter-rater reliability.

The illustrative lesson assumes that students have already encountered simple lists and dictionaries in their computing course. It asks them to compare ways of storing and retrieving information in a small inventory. The examples, lesson timings and scoring rules are author-developed proposals. They describe how a lesson could be organised, not how an actual class performed. No student data, examination scores or interview responses were collected.

Three safeguards shape the design. The teacher retains the technical meaning of the source when shortening an excerpt. A content specialist checks any adapted explanation and task answer. Assessment includes a new example so that reproducing the worked example cannot satisfy the entire task. Together these safeguards make the design inspectable without claiming that it has been validated.

The analytical outputs are reported as a selection procedure, a reading sequence and an assessment specification. A subsequent empirical study would be necessary to estimate learning gains, compare different types of support or examine whether students retain and transfer the targeted vocabulary.

Results

Selecting documentation for integrated learning

The first result is a procedure for choosing a manageable reading unit. The teacher begins with a technical question, such as how to retrieve the quantity associated with a named inventory item. The passage is then selected because it supplies information needed to answer that question. This reverses the common practice of choosing a long interesting text first and adding language exercises afterward.

The reading unit should be short enough for learners to revisit it several times. Its boundaries should preserve the condition or explanation on which the technical decision depends. Removing a difficult

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sentence merely because it contains unfamiliar vocabulary can destroy the logic of the passage. The teacher should instead identify whether a gloss, a diagram or a preliminary concept check can make that sentence usable.

Vocabulary selection follows communicative importance. Some words name essential concepts, such as "dictionary" or "key". Others express technical actions, such as "retrieve" or "modify". A third group organises the reasoning, including conditional expressions and words signalling contrast. Teaching only the nouns leaves students without the language required to understand how the concepts relate. The local vocabulary set should therefore include meaningful phrases as well as individual terms.

The teacher also checks conceptual prerequisites. A learner who does not understand the difference between a collection and an element may misread a clear sentence about a data structure. That difficulty should be addressed through a small technical example before the English reading task. Additional translation alone may not resolve it. The diagnostic distinction helps avoid attributing every comprehension problem to language proficiency.

Source management is part of selection. The lesson record should identify the documentation version, section, access date and any edits. Students should know whether they are reading an original excerpt, an abridged passage or a teacher-written explanation. If a passage is adapted, its source should remain visible, and the adapted text should not be presented as a verbatim official statement.

The proposed benefit is a closer relation between reading effort and useful technical action. Students can see why they need the passage and what a successful reading enables them to do. That relevance may support engagement, but engagement is not assumed to prove vocabulary acquisition. The assessment must still examine whether the learner remembers the terms and interprets a new passage accurately.

Connecting textual features with reading evidence

The second result is a matrix linking documentation features to tasks. It is designed to help teachers distinguish language difficulty from technical misunderstanding. The tasks are original instructional proposals; the examples use the general type of prose–code relationship found in official documentation.

Feature	Reading action	Evidence of understanding
Specialised meaning	Explain a term within the example	Contextual definition and appropriate use
Condition or restriction	Identify when an operation applies	Correct choice with a stated condition
Prose and code	Match an explanation to an example	Annotation showing the correspondence
Technical contrast	Compare two storage approaches	Reasoned choice for a new situation
Reference in a sentence	Identify what a pronoun refers to	Restated instruction with an explicit noun

For example, a student can be asked to explain what a "key" identifies in a small inventory dictionary. A correct response must connect the term with the data relationship in the example. Giving an

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everyday meaning of the word or a memorised translation is insufficient. The teacher can then change the example from inventory quantities to room locations and ask whether the same relationship still applies.

The official tutorial describes dictionaries through key–value relationships and lists through sequence operations [1]. The lesson uses this limited distinction as a starting point, without claiming that a short English activity can teach all the design considerations associated with these structures. Students explain why one representation fits the specified retrieval requirement, while acknowledging the assumptions of the example.

The matrix also supports targeted feedback. If a learner selects the correct operation but cannot identify the sentence supporting it, the answer may reflect prior programming knowledge. If the learner finds the relevant sentence but misinterprets a condition, the next task should focus on that relation. Evidence from both stages is needed before attributing success or failure to reading comprehension.

An illustrative reading sequence

The proposed sequence begins with a small information problem and a prediction. Students inspect an inventory example and write what information they need to find. They then locate the relevant documentation passage and mark the sentence that appears to answer the question. This first reading establishes purpose and navigation; it does not require immediate translation of every word.

During the second reading, students annotate terms and relationships that affect the decision. They identify what each technical noun refers to in the example and underline conditions or restrictions. The teacher supplies a limited glossary for essential unfamiliar items. Students are asked to explain why the marked information matters, preventing annotation from becoming a decorative exercise in highlighting large portions of text.

The application stage asks learners to predict the result of a simple example before checking it. They record the prediction and the textual reason supporting it. If a programming environment is available, students may execute the example and compare the observed output with their prediction. If it is unavailable, the teacher can provide an output card after the prediction is recorded. Both versions preserve the central reading task.

Verification is followed by explanation in English. A learner states what the operation does, which part of the passage supports that interpretation and how the result addresses the original problem. A partner then changes one condition and asks whether the explanation still holds. This small variation tests whether the learner has understood a relationship rather than memorised an answer. It also makes the terminology useful in interaction.

An 80-minute lesson could allocate 10 minutes to diagnosis and the technical question, 15 to locating and reading, 15 to vocabulary and relations, 20 to prediction and verification, 15 to peer explanation and 5 to an exit task. These timings are a planning example, not a validated optimum. Teachers should adjust them according to the actual reading difficulty and the time needed for technical clarification.

The exit task uses a new miniature example and asks for a concise justification. Homework can revisit selected vocabulary in another short passage rather than repeat the original worksheet. A later retrieval task checks whether students can explain the terms without consulting the glossary. Across these stages, the intended progression is from supported interpretation toward more independent use of technical language under clearly recorded conditions.

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Discussion

Authentic documentation offers a direct connection with the reading practices students may encounter beyond the English classroom. Its educational value is strongest when students use the text to resolve a defined technical question. The integrated task can expose the limits of superficial word recognition: a student must relate the vocabulary to a condition, an example or a consequence. This gives the teacher a more informative basis for instruction than a score on isolated translation items.

At the same time, documentation introduces difficulties that a general reading lesson may not address. Code and prose must be interpreted together, section headings may assume prior knowledge and familiar words can carry technical meanings. Teachers should avoid assuming that short passages are necessarily easy. A single condition can require substantial conceptual understanding. Material selection must therefore consider the relationship between linguistic and technical complexity.

The approach also needs a careful understanding of success. Working code is useful evidence, but it is not equivalent to reading comprehension. A learner may copy an example, use prior knowledge or receive help from a peer. Conversely, a minor typing error can prevent execution even when the explanation is understood. The proposed sequence separates prediction, textual justification, execution and explanation so that the teacher can interpret these possibilities.

Assessment should retain three distinct results: contextual vocabulary knowledge, interpretation of the passage and application to a new example. A five-point scale can be used for each dimension, with descriptors and sample answers established before scoring. A high vocabulary score should require appropriate contextual use; a high interpretation score should require correct handling of the relevant relation; a high application score should require a justified response to the changed situation. These are suggested criteria requiring piloting.

Formative feedback should identify the feature that needs attention and provide an opportunity to revise. Black and Wiliam's discussion of formative assessment informs this general orientation [8]. In the present design, the practical action is to ask a student to repair one explanation and then interpret a similar relation in another sentence. Repeated correction of the same completed worksheet would offer weaker evidence of transfer.

The likely advantage over an unstructured documentation-reading assignment is greater transparency about what students are learning and why they make errors. Whether it also produces larger or more durable gains than other carefully designed approaches remains an empirical question. The article provides a framework for examining that question without conflating authenticity, motivation and achievement.

Limitations and directions for research

The analysis is limited to a small documentation domain and a conceptual teaching design. It does not establish how many terms students will acquire or how quickly their reading will improve. Learners with substantial programming experience may answer technical questions without closely reading the passage, while novice programmers may struggle despite adequate general English. Future studies must measure these starting differences rather than treat all IT students as a uniform population.

An evaluation could compare the proposed sequence with a carefully specified reading lesson using the same technical content and instructional time. Immediate measures should include unfamiliar examples and require textual justification. A delayed measure should assess retention of contextual meanings. Transfer could be examined with a different documentation section that uses a similar communicative function, such as describing a condition or explaining a contrast.

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Researchers should distinguish access to support from dependence on support. A student who checks one term in a glossary and then explains the passage independently has a different profile from one who requires sentence-by-sentence translation. Recording consultation behaviour, within feasible classroom limits, can help interpret the outcome. It should supplement performance evidence rather than become an intrusive measure of every reading action.

Teachers also need evidence about workload and accessibility. Preparing technically accurate excerpts and answer keys requires time, particularly when documentation changes. A shared collection of version-labelled passages can reduce repeated preparation. Printed alternatives and explicit visual descriptions can help maintain access where devices or connectivity are uneven. These implementation choices should be documented alongside achievement results.

Conclusion

CLIL can organise technical vocabulary and reading instruction around purposeful use of authentic software documentation. The proposed approach connects a technical question with selective reading, contextual vocabulary work, prediction, verification and explanation. Its main contribution is an evidence structure that makes lexical knowledge, textual interpretation and technical application separately observable.

The approach is most defensible when teachers preserve the source's technical meaning, diagnose prerequisite knowledge and assess performance on a new example. Authenticity should support a meaningful task rather than serve as a quality label by itself. The instructional sequence and assessment criteria offered here are ready for local adaptation and piloting, but their effectiveness remains to be tested through classroom research with transparent comparison conditions and delayed measures of retention.

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