

SEMANTIC ASYMMETRY OF TECHNICAL POLYSEMOUS UNITS IN ENGLISH AND UKRAINIAN: COGNITIVE CHALLENGES IN TEACHING ESP

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Abstract

This paper addresses the semantic asymmetry of technical polysemous units in English and Ukrainian and the cognitive difficulties it creates for learners of English for Specific Purposes (ESP). By examining selected examples from engineering and IT contexts, the study highlights how discrepancies in meaning, usage, and conceptual structure complicate comprehension and translation. The paper also outlines practical, cognitively informed strategies for overcoming these challenges in the ESP classroom.

Key words: technical polysemy, semantic asymmetry, English for Specific Purposes, cognitive challenges, ESP pedagogy.

Анотація

У цій статті розглядається семантична асиметрія технічних багатозначних одиниць в англійській та українській мовах і когнітивні труднощі, які вона створює для тих, хто вивчає англійську мову для спеціальних цілей (ESP). На основі аналізу вибраних прикладів з інженерної та IT-сфери, у дослідженні підкреслюється, як розбіжності в значенні, вживанні та концептуальній структурі ускладнюють розуміння та переклад. У статті також викладено практичні, когнітивно обґрунтовані стратегії подолання цих труднощів на заняттях ESP.

Ключові слова: офлайн-навчання, вивчення англійської мови, середовище з обмеженими ресурсами, технічна університетська освіта, самостійне навчання.

The rapid expansion of global technological communication has increased the demand for effective instruction in English for Specific Purposes (ESP), particularly in technical disciplines. However, one persistent and underestimated challenge in ESP instruction lies [1] in the semantic asymmetry of polysemous technical terms across languages. While polysemy is a natural linguistic phenomenon, the way multiple meanings are distributed and interpreted in English often diverges significantly from their counterparts in Ukrainian. This misalignment creates cognitive obstacles that can hinder comprehension, translation accuracy, and professional communication among learners.

For instance, “charge” spans physics, finance, and management, but the Ukrainian mappings split across “заряд”, “плата”, and “доручення”. Learners who anchor on a single default sense often misparse whole passages in technical manuals. The problem compounds when collocations [2] act as covert signals of meaning, as in *charge carrier* (носії заряду) vs *service charge* (плата за послугу). Similar ambiguities arise with *load* (навантаження) in electrical engineering vs software workflows, and with *drive* as *storage hardware* (апаратне забезпечення для зберігання даних) vs *causal force* (сила, що спричиняє рух). Without explicit contrastive instruction, students transfer L1 categories that do not align with English semantic fields. The result is increased cognitive load, slower reading, and error-prone translation choices in high-stakes contexts. Targeted teaching should foreground sense disambiguation through genre-specific corpora, concordances, and collocation lists. Glossaries must be sense-indexed, with examples that situate terms in typical sentences, diagrams, and problem sets. Assessment should include minimal-pair tasks that test recognition of meaning shifts across near-identical forms. Finally, instructors should require reflective error logs so learners can track recurring polysemy traps and recalibrate their mental models.

This work seeks to explore the cognitive and pedagogical implications of this phenomenon and suggest viable teaching strategies to support learners navigating technical polysemy in ESP settings.

Theoretical background

In linguistics, *polysemy* [3] refers to the capacity of a single lexical unit to possess multiple related meanings. Within technical discourse, polysemous units often evolve through metaphorical extension or functional adaptation, complicating their interpretation for non-native speakers. Unlike general vocabulary, technical polysemy operates [4] within specific conceptual frames that may not align between languages.

Semantic asymmetry, in this context, refers to the mismatch in meaning scope, frequency of usage, and cultural or professional associations between equivalent terms in English and Ukrainian. For example, a single English term may correspond to several Ukrainian equivalents depending on context, while a Ukrainian term may lack a concise English match altogether. These mismatches are particularly common [5] in technical fields where terms are rapidly evolving [6,7] and highly contextualized.

Cognitive challenges in ESP learning

Learners of ESP, especially those in engineering, IT, or energy sectors, often struggle with:

a) cognitive overload. The need to process multiple potential meanings under time constraints increases cognitive strain.

b) false equivalency. Students may assume one-to-one correspondence between English and Ukrainian terms, leading to conceptual confusion.

c) translation ambiguity. Without sufficient exposure to context-based usage, learners may choose incorrect or awkward equivalents.

d) semantic interference. Prior knowledge in the native language may block or distort [8] the acquisition of more appropriate foreign-language concepts.

Such issues are frequently observed in student writing, oral presentations, and translations, especially when learners rely on literal, dictionary-based interpretations without understanding functional or contextual variation.

Several polysemous terms illustrate the semantic complexity that ESP learners must [9] navigate.

Table 1.

Comparative analysis of some polysemous technical terms

Term	Core senses and examples	Ukrainian equivalents	Common learner issues
Charge	electric charge; a fee; to charge a battery; to assign responsibility	заряд; плата; заряджати; доручення	Overgeneralizing one meaning across all contexts
Load	electrical load; to load data; physical burden	навантаження; завантаження; тягар	Confusing technical vs metaphorical senses
Drive	hard drive; drive system; to drive innovation	диск; привід; рушійна сила	Blending literal and figurative meanings, causing ambiguity
Current	electric current; the current version; ocean/air current - "Measure the current in amperes"; "the current release"; "a strong current"	струм; поточний; течія	Mixing current (струм) with currency (валюта); confusing adjective vs noun uses; transferring "поточний" into contexts where "present" fits better
Power	electrical power; political/social power; to power (supply energy) - "power = VI"; "power outage"; "to power a device"	потужність; електроживлення; влада; жити/запускати	Treating all meanings as "потужність"; confusing power (потужність) vs energy (енергія); missing the verb use "to power" in technical writing
Ground	earth/soil; electrical ground (reference); reason/basis - "connect to ground"; "ground wire"; "grounds for rejection"	земля/грунт; заземлення; підстава/основа	Blending literal "земля" with electrical "заземлення"; translating "grounds" as "землі" instead of "підстави"; omitting the article in fixed technical phrases (e.g., "connect to ground")
Terminal	device location/connector; end point/final; computer terminal - "battery terminal"; "terminal block"; "terminal stage"; "open a terminal"	клема; термінал; кінцевий/остаточний; командний рядок/термінал	Overusing "термінал" for all cases (missing "клема"); confusing terminal (connector) with terminology; ambiguity in IT texts (hardware terminal vs CLI terminal)

Source: created by author.

These examples show how students must mentally map not just individual meanings but entire semantic networks that function differently in each language.

Pedagogical strategies and didactic solutions

To mitigate these challenges, ESP educators should adopt cognitively oriented methods that enhance learner flexibility and contextual awareness. Recommended strategies [10, 11] include the following. This entails explicit instruction in sense disambiguation, anchored in domain cues such as units, co-occurring verbs, and schematics. Teachers should integrate small corpus tools and concordance lines to surface genre-specific collocations that signal the intended meaning. Bilingual, sense-indexed glossaries with short, authentic examples help [12] learners map English senses to precise Ukrainian equivalents without overgeneralization. Regular translation with reflective rationales trains metacognitive monitoring and reduces default-to-one-sense errors in high-stakes tasks. Assessment should sample multiple genres and require justification of choices, while scaffolding gradually fades as learners internalize strategies.

Table 2.

Cognitively oriented ESP strategies for managing polysemy

Strategy	Purpose	Classroom activity	Assessment/check	Notes/tips
Conceptual mapping	Build flexible, context-aware sense networks for polysemous terms	Students create a node-link map for charge, load, drive with branches for each sense and real sentence examples from manuals	Spot-check maps for distinct senses, correct links, and authentic examples; 3-minute oral walkthrough per student	Start with 1 term per week; color-code domains (physics, IT, management)
Bilingual contrastive glossaries	Contrast meanings across EN-UKR with usage patterns	Pairs co-write entries: EN definition, collocations, sentence, UKR equivalents, domain tag	Quick quiz: match collocations to correct UKR equivalents and domains	Enforce one entry per sense; add typical collocations and false friends
Contextual learning	Expose learners to authentic usage in genre-specific texts	Jigsaw reading of a datasheet, a user manual, and a case study highlighting the same term in different senses	Exit ticket: identify the sense in 3 new sentences and justify with textual cues	Pre-teach genre signals like units, diagrams, and section headers
Cognitive apprenticeship	Model expert strategies for sense disambiguation	Teacher think-aloud on an unfamiliar paragraph, highlighting cues like units, verbs, and neighbouring terms	Learners annotate a paragraph with the cues they used; peer review annotations	Use gradual release: model – guided practice – independent practice
Translation tasks with reflection	Make learners articulate and evaluate their choices	Translate a short procedure with highlighted polysemous terms, then write a 5-sentence rationale for each choice	Rubric: accuracy, consistency of domain, quality of rationale	Encourage versioning: draft – reflect – revise; track recurring traps in a log

Source: created by author.

These techniques help students [13] develop not just lexical knowledge but cognitive agility and disciplined, context-sensitive reasoning skills when confronted with ambiguous or unfamiliar terms.

Conclusion

Semantic asymmetry in technical polysemy poses a significant cognitive and pedagogical challenge in ESP instruction. As technical language continues to evolve, the ability to navigate multiple meanings across linguistic and conceptual boundaries becomes a vital skill for future professionals. By incorporating context-rich, contrastive, and cognitively informed strategies, educators can better prepare students to engage with technical discourse in a nuanced and competent way.

Further research may focus on the automation of polysemy analysis in corpora, or on the development of digital tools that support contrastive semantic learning in technical ESP domains.

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