

THE ROLE OF CHEMICAL TERMS IN DEVELOPING SCIENTIFIC LANGUAGE COMPETENCE

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Abstract. This article examines the role of chemical terms in developing scientific language competence among learners of a foreign or second language. Chemical terminology is not only a set of specialized words but also a system of scientific concepts, classifications, symbols, formulas, processes and logical relations. The article argues that learning chemical terms helps students understand scientific texts, participate in academic communication, interpret laboratory instructions, explain processes, compare substances, describe reactions and use precise language in written and oral discourse. Particular attention is paid to terminology, nomenclature, academic vocabulary, conceptual understanding, interdisciplinary learning and communicative competence in science education.

Keywords: chemical terminology, scientific language competence, academic vocabulary, chemistry education, foreign language learning, scientific discourse, nomenclature, communicative competence.

INTRODUCTION

The development of scientific language competence is one of the essential aims of modern education, especially in contexts where students learn science through a foreign or second language. Scientific competence cannot be reduced to memorizing facts, formulas or definitions. It requires the ability to understand concepts, interpret specialized texts, describe processes, formulate explanations, compare phenomena and communicate evidence-based conclusions. In this process, chemical terminology plays a central role because chemistry is built on a precise system of names, symbols, formulas and conceptual relations. Terms such as atom, molecule, acid, base, oxidation, reduction, solution, solvent, valence, isotope and catalyst are not ordinary vocabulary items; they are linguistic forms that carry scientific meaning.

Chemical terms are particularly important because they connect language with conceptual thinking. A learner who knows the word reaction only as a general English word may not immediately understand its chemical meaning as a process in which substances are transformed into other substances. Similarly, the term bond may be understood in ordinary language as a connection between people, but in chemistry it refers to specific interactions between atoms. Therefore, the learning of chemical terminology develops the learner's ability to distinguish everyday meaning from scientific meaning. The IUPAC Gold Book, widely used as a reference for chemical definitions, demonstrates that chemical terms require conceptual accuracy and internationally accepted interpretation [1].

MATERIALS AND METHODS

Chemical terminology contributes to scientific language competence by forming the lexical foundation of scientific understanding. Without specialized vocabulary, a learner cannot read a chemistry textbook, follow a laboratory instruction, understand a scientific article or explain a chemical process. Vocabulary learning in science differs from ordinary word learning because

each term is connected with a concept, a classification system and a specific field of use. For example, the term compound cannot be learned only through translation; it must be understood in relation to element, mixture, molecule, chemical formula and chemical bond. Thus, chemical vocabulary develops not only memory but also conceptual organization. Nation's research on vocabulary learning shows that vocabulary knowledge includes form, meaning and use; this distinction is especially relevant to scientific terminology because learners must recognize the written form, pronounce the term, understand its meaning and use it correctly in scientific contexts [6].

The role of chemical terms is also visible in the development of accuracy. Scientific communication requires precise language because small lexical differences may change the meaning of an explanation. For example, melting and dissolving are often confused by learners, although they refer to different processes. Mass and weight are also different scientific concepts, even if they are sometimes used interchangeably in everyday speech. When learners acquire chemical terminology correctly, they learn to avoid vague descriptions and replace them with accurate scientific statements. Instead of saying "the material disappears in water," a scientifically competent learner can say "the substance dissolves in water and forms a solution." This movement from everyday expression to scientific explanation is an important indicator of language development.

RESULTS AND DISCUSSION

Chemical nomenclature is another major factor in scientific language competence. Chemistry uses systematic naming rules that allow scientists from different countries to identify substances accurately. Names such as sodium chloride, calcium carbonate, sulfuric acid, methane, ethanol and ethanoic acid are not random labels; they reflect the composition, structure or classification of substances. IUPAC recommendations on chemical nomenclature are designed to support clear and consistent communication in chemistry [2]. For language learners, nomenclature develops analytical reading skills because the learner can break down a term into meaningful parts. Prefixes, suffixes and roots such as mono-, di-, tri-, -ide, -ate, -ite, hydro-, oxo- and -ol provide clues about chemical identity and structure.

Chemical terms also help learners understand the grammar of scientific discourse. Scientific language often uses nominalization, passive constructions, definitions, classifications and cause-effect relations. For instance, instead of saying "when a substance reacts with oxygen, it changes," scientific discourse may use the phrase "oxidation involves the loss of electrons or an increase in oxidation state." This sentence contains abstract terminology and compressed meaning. Halliday and Martin emphasize that scientific discourse has specific linguistic patterns, including dense noun phrases and technical vocabulary, which allow complex knowledge to be expressed economically [3]. Chemical terms therefore introduce learners to the wider structure of academic and scientific language.

In foreign language learning, chemical terminology can serve as a bridge between content learning and language learning. Students who study chemical terms in English, for example, do not merely learn isolated English words; they learn how English functions as a medium of scientific explanation. This is particularly important in content and language integrated learning, English for specific purposes and science-oriented language education. When students read short texts about chemical reactions, describe laboratory procedures, write reports or discuss environmental chemistry, they develop both subject knowledge and language competence. The term becomes a unit of interdisciplinary learning: it belongs to chemistry, but it also develops reading, writing, speaking and listening skills.

Chemical terms improve reading competence because scientific texts depend heavily on terminology. A student who cannot recognize key terms will struggle to understand the main idea

of a passage even if they know general grammar. In a text about acids and bases, terms such as pH, neutralization, indicator, alkali, hydrogen ion and salt are central to comprehension. Reading strategies in scientific language must therefore include term identification, definition analysis, context-based interpretation and concept mapping. Wellington and Osborne argue that language is central to science education and that students need support in reading, understanding and using scientific language effectively [4].

Chemical terminology also supports writing competence. Scientific writing requires students to produce definitions, describe experiments, report observations, explain results and draw conclusions. A learner who knows chemical terms can write more precise and logically organized texts. For example, in a laboratory report, the student must distinguish between observation, result, inference, reaction, precipitate, solution and conclusion. The correct use of these terms makes the report scientifically meaningful. Without terminology, the writing remains informal and imprecise. Therefore, chemical terms help students move from everyday narration to academic description and explanation.

Speaking competence is also developed through chemical terminology. In classroom discussions, laboratory work and presentations, students need to explain processes aloud. They may need to describe how a solution is prepared, why a reaction occurs, what safety measures are necessary or how a chemical substance is classified. Such speech requires not only pronunciation but also conceptual clarity. Lemke's work on science discourse stresses that learning science involves learning how to "talk science," meaning that students must learn the patterns of explanation, argument and representation used in scientific communities [5]. Chemical terminology provides the lexical and conceptual resources needed for this kind of speech.

The importance of chemical terms is especially clear in laboratory communication. Laboratory instructions often contain imperative and procedural language: measure, heat, stir, filter, evaporate, observe, record, compare, dispose. These verbs are combined with chemical nouns and safety terms such as reagent, beaker, pipette, acid, flammable, corrosive, toxic and protective equipment. If students misunderstand such terms, the problem is not only linguistic but also practical and potentially dangerous. Scientific language competence therefore includes the ability to understand and follow procedural terminology accurately.

Chemical terminology also develops critical thinking. Terms in chemistry are often linked by classification and logical relations. Learners must understand that metals and non-metals are broad categories, that organic compounds differ from inorganic compounds, that exothermic and endothermic processes describe energy change, and that oxidation and reduction are complementary processes. Such terms help learners organize knowledge into systems. When students compare, classify and explain these terms, they develop analytical habits of thought. Terminology becomes a tool for reasoning, not merely a list of words.

Another important aspect is the role of chemical terms in translation and multilingual learning. In many educational contexts, students learn chemistry in one language and read additional materials in another. They may know a term in their mother tongue but fail to recognize its English equivalent. For instance, the learner may understand the concept of kislota in Uzbek but need to connect it with the English term acid. Such bilingual or multilingual terminology work strengthens both conceptual and linguistic competence. It also helps prevent mechanical translation errors, especially in cases where everyday words and scientific terms do not match exactly.

CONCLUSION

Chemical terms play a fundamental role in developing scientific language competence. They provide the lexical basis for understanding chemistry, but their importance goes beyond vocabulary. They develop conceptual thinking, accuracy, academic reading, scientific writing, oral explanation, laboratory communication, classification skills and interdisciplinary learning.

Chemical terminology helps learners move from everyday language to scientific discourse, from vague description to precise explanation, and from passive memorization to active knowledge construction.

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