ISSN: 2181-3906 2026

International scientific journal
«MODERN SCIENCE AND RESEARCH»
VOLUME 5 / ISSUE 11 / UIF:8.2 / MODERNSCIENCE.UZ

TEACHING PHYSICS THROUGH ENGLISH: THE ROLE OF CONTENT AND LANGUAGE INTEGRATED LEARNING (CLIL) IN DEVELOPING STUDENTS' SCIENTIFIC AND LINGUISTIC COMPETENCE

Xakimova Gulchehra Abdulla qizi
Physics Teacher at Academic Lyceum No. 2 of Fergana State Technical University.
Abdumalikova Gulhayo Shavkat qizi
Student of Group 25.131, Faculty of Foreign Languages, Department of Philology and Teaching Languages: English, Fergana State University.

https://doi.org/10.5281/zenodo.24396360

Abstract. *This article examines the pedagogical significance of Content and Language Integrated Learning (CLIL) in physics education and its role in developing both students' scientific understanding and their command of English. It argues that physics is not only a system of laws and formulas but also a specialised language with its own vocabulary, grammatical patterns, and ways of reasoning. Students who struggle to explain a physical phenomenon often lack the language needed to express their thinking, rather than the thinking itself. When English is used purposefully as a medium for learning physics, students acquire subject knowledge and academic language at the same time, and each strengthens the other. The paper discusses the theoretical foundations of CLIL, the linguistic features of physics discourse, practical strategies for planning and teaching physics lessons through English, the role of scaffolding and assessment, and the professional competencies required of teachers. Drawing upon established research in science education and applied linguistics, the article concludes that CLIL is an effective approach for improving the quality of physics education, increasing student motivation, and preparing learners for international academic and professional communication.*

Keywords: *Content and Language Integrated Learning (CLIL), physics education, English for specific purposes, scientific literacy, academic language, scaffolding, bilingual education, teaching methodology, student motivation, interdisciplinary learning.*

Introduction

In a rapidly globalising world, the ability to understand and communicate scientific ideas in English has become an essential part of a modern education. Most international scientific journals, conferences, textbooks, online courses, and research databases in physics operate primarily in English. Consequently, students who wish to continue their education at leading universities, take part in international olympiads, or work in technical and engineering fields need more than a general knowledge of the language. They need the ability to read a physics text, follow a scientific explanation, describe an experiment, and argue for a conclusion in English. At the same time, physics teachers increasingly recognise that many difficulties students face in their subject are, at least partly, difficulties of language. A student may know how to substitute numbers into a formula yet be unable to explain why a ball thrown upwards slows down or what the word "momentum" actually means.

The idea that language and subject learning are closely connected is not new. Lev Vygotsky argued that language is the main tool through which human thinking develops, and that learning proceeds most effectively within the Zone of Proximal Development, with appropriate support from a teacher or a more capable peer. Jay Lemke, in his study of science classrooms, showed that learning science means learning to "talk science": to use its terms, sentence patterns, and forms of reasoning. Jim Cummins drew an influential distinction between everyday conversational language and cognitive academic language proficiency, noting that the latter takes considerably longer to develop and must be taught deliberately. Building on these ideas, Do Coyle, Philip Hood, and David Marsh developed a comprehensive framework for Content and Language Integrated Learning, in which a subject is taught through a second language and both content and language are treated as explicit learning goals.

This approach is also reflected in national educational policy. In Uzbekistan, the Presidential Resolution No. PQ–1875 of 10 December 2012 "On measures to further improve the system of learning foreign languages" set the goal of teaching specialised subjects in foreign languages, particularly in technical and natural science fields. Within this framework, physics is especially well suited to integration with English. Its concepts are universal, its symbols and units are international, and its terminology is largely shared across languages. For this reason, teaching physics through English is increasingly regarded not as an experiment but as a natural direction for improving both scientific and language education.

Main Body

Content and Language Integrated Learning may be defined as a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language. In a CLIL physics lesson, English is not the subject of study in the traditional sense; it is the medium through which students explore motion, energy, electricity, or optics. At the same time, the teacher deliberately plans the language that students will need in order to understand and express these ideas. The primary objective of this approach is not to turn a physics lesson into an English grammar lesson, nor to simply translate a lesson from the native language into English. Instead, it represents a carefully balanced strategy in which subject knowledge and language skills develop together and support each other.

Coyle, Hood, and Marsh describe CLIL through the "4Cs" framework: content, communication, cognition, and culture. In physics, content refers to the concepts and laws being studied, such as Newton's laws of motion. Communication refers to the language students use to learn and to demonstrate their learning, for example, describing forces acting on a body. Cognition refers to the thinking skills involved, such as predicting, comparing, classifying, and drawing conclusions from experimental data. Culture refers to the awareness that science is an international human activity, shaped by scientists of many nations who share a common language of research. A well-designed CLIL lesson addresses all four dimensions rather than focusing on one of them alone.

Classroom experience shows that physics discourse has distinctive linguistic features that students must learn to recognise and use.

First, physics has a highly specialised vocabulary, including terms such as “velocity,” “acceleration,” “resistance,” and “wavelength.” Some everyday words, such as “work,” “power,” “force,” and “pressure,” acquire precise scientific meanings that differ from their ordinary use, which can create misconceptions. Second, physics texts frequently use the passive voice (“the current is measured”), conditional sentences (“if the temperature increases, the volume expands”), comparatives (“the greater the mass, the smaller the acceleration”), and cause-and-effect connectors such as “therefore,” “as a result,” and “due to.” Third, as Halliday and Martin have shown, scientific English relies heavily on nominalisation, turning processes into nouns, as in “the expansion of gases” or “the reflection of light.” When teachers explicitly draw students’ attention to these features, students begin to understand not only what a physics text says but also how scientific explanations are constructed.

One of the most effective ways of implementing CLIL in physics is through scaffolding, a term rooted in Vygotsky’s theory and developed further by Pauline Gibbons. Scaffolding means providing temporary support that allows students to complete tasks they could not yet perform independently, and gradually withdrawing that support as their competence grows. In a lesson on electric circuits, for example, the teacher may begin with a labelled diagram and a short glossary of key terms. Students then work with sentence frames such as “When the switch is closed, the current…” or “The resistance increases because…” to describe their observations. Later, they write a short laboratory report using a model text as a guide. Finally, more advanced learners explain an unfamiliar circuit without any frames at all. Importantly, every student studies the same physical concepts, yet the degree of language support is adjusted to their current level.

Practical and visual activities play a particularly important role in CLIL physics lessons.

Experiments, demonstrations, simulations, graphs, and diagrams make abstract concepts concrete and reduce the language load, because students can see what is being described. A student who observes a pendulum swinging can more easily understand and use the words “amplitude,” “period,” and “frequency” than one who only reads their definitions. Interactive online simulations, such as the PhET collection developed at the University of Colorado Boulder, are especially useful, since they allow students to change variables, observe results, and describe what happens in English. Pair and group work further strengthens this process. When students predict an outcome, discuss it with a partner, test it, and then explain the result to the class, they use language purposefully and develop deeper conceptual understanding at the same time.

Assessment occupies a central position in CLIL because teachers must evaluate two kinds of learning without confusing them. A student who gives a correct physical explanation with minor grammatical errors should not be judged as having failed to understand the physics.

Conversely, a correct numerical answer does not prove that a student can explain the underlying concept. For this reason, teachers are advised to define separate but connected criteria for content and language and to make these criteria clear to students in advance. Formative assessment techniques, such as short oral explanations, concept questions, exit tickets, and peer feedback, help teachers identify where students struggle, whether in physics, in English, or in both, and adjust their instruction accordingly.

Collaboration between physics and English teachers also contributes significantly to the success of CLIL. Physics teachers bring deep subject knowledge and an understanding of typical conceptual difficulties, while English teachers bring expertise in vocabulary instruction, grammar, and the development of reading and writing skills. When they plan together, the English teacher can pre-teach the language of an upcoming physics topic, while the physics teacher can reinforce that language through experiments and problem solving. This kind of partnership is especially valuable in academic lyceums and universities, where future engineers, physicists, and language specialists can learn from one another. It also benefits future English teachers, who gain experience in teaching English for specific purposes.

Another important advantage of CLIL is its positive effect on student motivation. Students often perceive English as more meaningful when they use it to solve real problems rather than to complete isolated grammar exercises. Similarly, physics becomes more attractive when students realise that they can read international sources, watch lectures by scientists from around the world, and take part in global academic communities. Research on interactive engagement in physics, including Richard Hake's large-scale survey of introductory physics courses, has shown that students learn considerably more when they actively discuss and apply concepts rather than passively listen to lectures. CLIL naturally encourages such active, communicative learning.

Nevertheless, CLIL also presents certain challenges that should not be ignored. Teachers may lack sufficient English proficiency or methodological training, suitable teaching materials may be limited, and students with weaker language skills may initially feel anxious or fall behind.

Lessons can also progress more slowly at first, because time is needed for language support. These difficulties can be reduced through gradual implementation, for instance, by beginning with selected topics or a few lessons per term, by using the native language strategically to clarify complex ideas, and by investing in teachers' professional development. CLIL should therefore be viewed as a flexible approach that is adapted to learners' needs, rather than a rigid model that requires the complete exclusion of the native language.

Conclusion

Educational practice clearly demonstrates that learning physics and learning the language of physics are inseparable processes. Students cannot fully understand a scientific concept unless they can express it, and they cannot express it unless they possess the necessary language. Content and Language Integrated Learning acknowledges this close relationship and organises teaching accordingly. Rather than treating English and physics as separate subjects competing for students' time, it allows each to strengthen the other.

The effectiveness of CLIL in physics education extends far beyond simply delivering lessons in English. Its success depends upon careful planning of both content and language objectives, explicit attention to the features of scientific discourse, systematic scaffolding, the use of experiments and visual materials, fair assessment of both content and language, and close collaboration between physics and English teachers. When implemented systematically, CLIL increases student engagement, deepens conceptual understanding, improves academic reading, writing, and speaking skills, and builds students' confidence in using English for real scientific

purposes. Ultimately, the purpose of contemporary physics education is not only to ensure that students can solve problems and memorise laws, but also to enable them to think, communicate, and collaborate as members of the international scientific community. Teaching physics through English represents a theoretically grounded and practically effective approach for achieving this goal. As educational systems continue to strengthen foreign language learning and the integration of subjects, CLIL will remain an important strategy for preparing a new generation of scientifically literate and internationally competent young people.

References

1. Coyle, D., Hood, P., & Marsh, D. (2010). *CLIL: Content and Language Integrated Learning*. Cambridge: Cambridge University Press.
2. Lemke, J. L. (1990). *Talking Science: Language, Learning, and Values*. Norwood, NJ: Ablex.
3. Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.
4. Cummins, J. (2008). BICS and CALP: Empirical and Theoretical Status of the Distinction. In B. Street & N. H. Hornberger (Eds.), *Encyclopedia of Language and Education* (2nd ed., Vol. 2, pp. 71–83). New York: Springer.
5. Halliday, M. A. K., & Martin, J. R. (1993). *Writing Science: Literacy and Discursive Power*. London: Falmer Press.
6. Gibbons, P. (2015). *Scaffolding Language, Scaffolding Learning: Teaching English Language Learners in the Mainstream Classroom* (2nd ed.). Portsmouth, NH: Heinemann.
7. Hake, R. R. (1998). Interactive-Engagement versus Traditional Methods: A Six-Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses. *American Journal of Physics*, 66(1), 64–74.
8. Wellington, J., & Osborne, J. (2001). *Language and Literacy in Science Education*. Buckingham: Open University Press.
9. O‘zbekiston Respublikasi Prezidentining 2012-yil 10-dekabrdagi PQ–1875-son qarori. Chet tillarni o‘rganish tizimini yanada takomillashtirish chora-tadbirlari to‘g‘risida. Toshkent, 2012.
10. Abdusubxon o‘g‘li U. S. REASONS AND SPECIFIC ADVANTAGES OF TEACHING PHYSICS IN MEDICAL INSTITUTES // American Journal of Philological Sciences. – 2024. – T. 4. – №. 12. – C. 26-31.