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The Role of CLIL Science Teachers in Teaching Writing Skills

Abstract: Content and Language Integrated Learning (CLIL) is becoming more and more valued as an educational solution to teaching foreign languages. The role ascribed to meaning (content) in communicative processes seems to explain the increasing popularity and spread of integrative approaches to teaching foreign languages across Europe and in the world. The explanation of the effectiveness of CLIL can also be sought in our understanding of how second language acquisition takes place. The theoretical part of the paper outlines the links made between the outcomes of second language acquisition research and CLIL and sheds some light on the role of meaning in communicative processes. The empirical study investigates the role of teachers in CLIL science classrooms in the context of writing scientific reports and the role of English of CLIL science classes in teaching referencing skills. The results of the research indicate to the roles that CLIL science teachers should play in the development of writing skills, including the use of referencing styles. There is also some evidence to suggest that in order for the successful integration of content and language to occur, some form of cooperation between language and CLIL content teachers should exist, especially in the context of teaching referencing skills.

Keywords: CLIL, SLA research, role of teachers, writing skills, referencing styles, teacher cooperation

1. Introduction

Although teaching content in a foreign language has a history of many centuries, Content and Language Integrated Learning (CLIL) was developed as a formal educational approach only after the immense success of the Canadian immersion programmes in the 1970s. The term itself was coined in 1994 by David Marsh and Anne Maljers to refer to “a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language” (Coyle et al. 2010: 1, original emphasis and bolding). Presently, CLIL has many correlates: bilingual education, LAC (Language Across the Curriculum),

EAC (English Across the Curriculum), CBI (Content-Based Instruction) CBLT (Content Based Language Teaching) and CLIT (Content and Language Integrated Teaching), just to mention a few (Lyster 2007; Pawlak 2010). However, as CLIL is the most prevalent term used in the literature on integrative contexts, it will be used throughout this article.

Teaching content *in* and *through* a foreign language in Poland, although informally present in school practices (for regional languages) since the interwar period, was only formalized by the School Education Act of 7 September 1991. This change to the educational law introduced a possibility of formal bilingual provision in primary, lower secondary and secondary schools of mainstream education. Additionally, two years later the first sections of the International Baccalaureate were also implemented in Polish schools. It has been almost 25 years now since the onset of formalized bilingual education and it can be said that content and language integrated learning is now thriving in Poland, with 256 bilingual schools (ORE n.d.) and 42 IB World Schools (IBO n.d.) operating. The languages of bilingual provision include English, German, French, Spanish, Italian and Russian.

The development and increase in the popularity of CLIL is strictly connected with our understanding of second language acquisition as well as the outcomes of studies investigating CLIL as an educational approach. The aim of the present paper is to investigate the role of CLIL science teachers in facilitating the process of teaching how to write scientific reports from the linguistic perspective.

2. Content and Language Integrated Learning in the light of Second Language Acquisition Research

Second language acquisition research has been trying to explain the ways in which people learn a second/foreign language — a language that is not their mother tongue. The outcomes of the research have led to tremendous changes in the perception of what successful teaching of foreign languages should look like. CLIL is one of the promising developments in the field of foreign language teaching, especially in teaching English, which has become a *lingua franca*. The theoretical assumptions of CLIL are deeply embedded in the theories of second language acquisition (SLA). This section elaborates on selected aspects of the findings of SLA that make CLIL a well-suited approach to teaching foreign languages, i.e., the role of motivation and the role of negotiation for meaning in communicative processes.

According to Dörnyei (2006), individual differences (IDs), which are defined as the dimensions of the features of individuals that all people are considered to share, but, at the same time, that make all people vary, “have ... been found to be consistent predictors of success in second language acquisition ..., yielding

multiple correlations with language attainment in instructed settings” (2006: 42). He states that the five most impactful ID areas are personality, aptitude, motivation, learning styles and learning strategies.

Not underestimating the role of other aspects of IDs, motivation seems to be a powerful drive for language learning in CLIL classrooms. The definition of the concept of motivation itself still raises many doubts, but it has been widely discussed elsewhere (Dörnyei 2001, Dörnyei 2014, MacIntyre, 2002). What most researchers into motivation would accept as the common denominator of all motivation definitions would be that “motivation determines the direction and magnitude of human behavior or, in other words, the choice of a particular action, the persistence with it, and the effort expended on it” (Dörnyei 2014: 512). Out of the seven suggested dimensions of motivational constituents (Dörnyei 2001), CLIL is clearly associated with at least two — the affective dimension and the instrumental dimension.

The affective (integrative) dimension refers to “a general affective ‘core’ of the L2 motivational complex related to attitudes, beliefs and values associated with the process, the target and the outcome of learning” (Dörnyei 2001: 400). What can be implied is that it might be simply more interesting, and thus motivating for a student to learn about specific content processes/events such as the working of the human heart or the causes and consequences of the Second World War, rather than standardized and predictable readings offered by EFL course books. In this way, students’ curiosity will be more easily aroused and maintained, because they will be personally engaged in the learning tasks they are challenged by. The other motivational dimension that might be driven by CLIL is the instrumental (pragmatic) motivation. This term refers to the extrinsic forces determining the amount of effort made by an individual in order to learn an L2. The instrumental motivators include passing an examination or getting a better-paid job. In the school setting, especially at the secondary level, CLIL opens up academic opportunities — students study about content matter using a foreign language, because they want to study abroad, at well-recognized universities (Dörnyei 2001, Ellis 2003) and then pursue their international career, as often happens with, for instance, doctors of medicine.

The second aspect of our understanding of SLA that explains the effectiveness of CLIL is the perception of the role of negotiation for meaning in verbal communication in language learning contexts.

Verbal communication can be considered a form of interaction, in which, in a given sociocultural context, people exchange information by sending and receiving meaningful messages. According to Dakowska, “meaning is the **causal factor** of verbal communication, causal in the sense of a necessary and sufficient condition for a given phenomenon” (2014: 51). In language learning, the target language is used by performing relevant tasks for the communicative needs. Following Dakowska, “to make language learning happen . . . , we must provide the learner with input, interaction and feedback” (2014: 53).

In CLIL, input, being the language that students are exposed to when learning a foreign language (Ellis 2003), is derived from a subject area and is richly delivered in a wide variety of discourse genres. Moreover, “input is indispensable to learn form/meaning and meaning/form mappings” (Dakowska 2014: 61). Interaction is the mutual influence between the interlocutors to produce and exchange written or spoken language, which, in a classroom context, can take place between learners or between a learner and the teacher. In CLIL, tasks, which are considered the natural units of learning languages, are typical of a given content area and allow its mastery to a higher degree compared to a mixed array of tasks from different areas. Additionally, tasks in CLIL are not deprived of their intrinsic authenticity, specific for the content area. Reading and listening comprehension tasks activate background content knowledge to enable discourse recognition. In both cases, it is the content (meaning) that matters and forms are subordinate to it. As for the productive tasks (speaking and writing), content provides “the causal factor of verbal communication” (Dakowska 2014: 51, emphasis removed), i.e., the meaning to be conveyed. It makes language learners use the language in order to communicate a meaningful message. Lastly, feedback on students’ production provides them with the information on what they still have to modify in their mental representations in order to follow the target language norms more accurately and convey the content (meaning) with a greater degree of precision.

Although meaning remains the core of communication in CLIL, there is also space for the improvement of form. In fact, Micheal Long’s interaction hypothesis states that interaction is key to the development of a second language not only because it offers opportunities to practice, but also because this is the actual way in which learning occurs. His interaction hypothesis holds that “*negotiation for meaning*, and especially negotiation work that triggers *interactional* adjustments by the native speaker or more competent interlocutor, facilitates acquisition because it connects input, internal learner capacities, particularly selective attention, and output in productive ways” (Long 1996, qtd. after Gass 2007: 234, original emphasis). Also, “it is proposed that environmental contributions to acquisition are mediated by selective attention and the learner’s developing L2 processing capacity, and that these resources are brought together most usefully, although not exclusively, during negotiation for meaning” (Long 1996, qtd. after Gass 2007: 235, original emphasis). It is further argued that negative feedback that results from the interaction during negotiation for meaning facilitates improvements in L2 in various areas, including lexis, grammar or specific L1–L2 differences.

If we assume that our present understanding of verbal communication is true, i.e., if it is true that meaning is the driving force behind all communication, we cannot underestimate the potential of CLIL in providing a wide range of meaningful and authentic contexts for communicative purposes and the development of second language.

3. The research

The following chapter is a description of the research. It is divided into three sections providing basic information about the rationale behind the research and its aims as well as a brief description of the research sample and methodology.

3.1. Justification and aim

Research article is a genre that is commonly practiced neither in a regular EFL classroom nor in science classes. In EFL classrooms, language teachers are not qualified content-wise, while in science classrooms, there is never enough time to teach the whole process so the students are only taught the basics, which include stating research questions and one-sentence conclusions. The language skills required to write a complete report on a scientific research have to be, therefore, taught from scratch. The task is challenging not only because it involves the use of advanced mental processing connected with a scientific analysis of the outcomes of an investigation, but also because the language is not of everyday use. The aim of this study was to investigate the role of science (biology, chemistry and physics) teachers in facilitating to process of writing scientific reports from the linguistic perspective and the roles of language and science classes in teaching students how to reference properly.

3.2. The participants

The study was conducted on students and teachers of the International Baccalaureate Diploma Programme (IB DP), which is an educational programme for students aged 16–19, a parallel alternative to the Polish secondary school national curriculum. In the IB DP, all students are expected to choose at least one of the sciences on the school's offer and the final grade for the subject on the certificate is based not only on a written exam, but also on a write-up of a report of an individual scientific investigation; hence, the need to teach students the know-how of writing scientific reports is real.

The participants of the study were 38 science teachers (biology, chemistry and physics) teaching in the International Baccalaureate Diploma Programme (IB DP) and 93 students from two private schools offering the International Baccalaureate Diploma Programme located in Warsaw. The collection of data from the teachers took place during a workshop for IB science teachers held in Gliwice in November 2014 and the teachers represented almost a half of all schools in Poland offering the IB Diploma Programme (N=15, 40%). As for the students, some of the participants were of non-Polish origin; however, English was a second/foreign language for all of them. The medium of instruction in all subjects in the IB DP, apart from foreign languages, is English, so all student participants were exposed to at least

30 teaching hours of English a week. What is more, both schools pre-select students based on general English proficiency. Thus, it was assumed that all students can cope with the challenges of writing a scientific report in English provided they are given appropriate instructions.

3.3. An outline of the methodology

The study was questionnaire-based. The questionnaire consisted of a number of statements grouped into four sections. The statements within each section had a common denominator; the questions in the sections referred to: the role of the science teacher in the process of writing a scientific report (Section 1), the role of the science teacher while marking a scientific report (Section 2), the role of English lessons in teaching how to reference properly (Section 3) and the role of science lessons in teaching how to reference properly (Section 4). Both groups of respondents were given the same questionnaire, with minor linguistic adjustments to address teachers/students (Appendix). The respondents were asked to decide to what extent they agree with each of the statements by choosing one of five alternatives: I strongly disagree, I somewhat disagree, It is hard to say, I somewhat agree or I strongly agree.

4. Results

The results of the survey were analyzed in groups corresponding to the sections of the questionnaire. The research question stated for Section 1 of the questionnaire aimed at investigating the role of CLIL science teachers in the process of teaching how to write scientific reports. The results of the study are shown in Table 1.

It can be seen from the table that a great majority of both groups of respondents claimed that the role of CLIL science teacher in the process of teaching how to write a scientific report is to (i) familiarize the students with a model report and direct the students' attention to (ii) technical vocabulary, (iii) grammar structures typical of a report, (iv) how the section *Background information* is organized and (v) how to organize the section *Evaluation*. It is most evident in the case of familiarizing the students with a model report and in directing the students' attention to technical vocabulary, where all respondents (N=93 students, N=38 teachers) and almost all respondents (N=89, 96% students; N=38, 100% teachers), respectively, 'strongly agreed' or 'somewhat agreed' with the statements in the questionnaire. The lowest result was for directing the students' attention to grammar structures typical of a report in the case of students (N=65, 70%), but the number is still very high.

Table 1. The role of the science teacher in the process of writing a scientific report (students N=93, teachers N=38)

In the process of teaching how to write <i>Lab reports</i> science teachers should...		Response				
		I strongly disagree	I somewhat disagree	It is hard to say	I somewhat agree	I strongly agree
...familiarize students with a model <i>Lab report</i> .	students	0%	0%	0%	14%	86%
	teachers	0%	0%	0%	18%	82%
...direct students' attention to technical vocabulary.	students	0%	0%	4%	34%	62%
	teachers	0%	0%	0%	37%	63%
...direct students' attention to grammar structures typical of a <i>Lab report</i> .	students	0%	9%	22%	22%	47%
	teachers	0%	8%	11%	55%	26%
...direct students' attention to how the section <i>Background information</i> is organized.	students	0%	9%	9%	27%	55%
	teachers	3%	5%	11%	39%	42%
...direct students' attention to how to organize the sections <i>Conclusions</i> and <i>Evaluation</i> .	students	0%	6%	6%	18%	70%
	teachers	0%	0%	3%	45%	52%

The other aspect investigated in the study was the role of CLIL science teachers while marking scientific reports. The results of the study (data not shown) indicate that CLIL science teachers should correct lexical mistakes and mistakes in the organization of the sections *Background information* and *Evaluation* as over 60% of respondents for both teachers and students ‘strongly agreed’ or ‘somewhat agreed’ with these statements in the questionnaire. The results, however, are inconclusive for the role of CLIL science teachers in correcting grammar mistakes while marking scientific reports since merely 51% of students (N=47) and 48% of teachers (N=18) expressed their agreement with the statements.

Finally, the study aimed to determine the role of English and science classes in teaching how to reference properly. Both groups of respondents agree that quoting a fragment of a book/article, making in-text citations and producing a bibliography belong in and should be taught in both subjects — English and the science. This is supported by the data shown in Table 2, where it can be seen that over 60% of students and CLIL science ‘strongly agreed’ or ‘somewhat agreed’ with the statements in the questionnaire. As for paraphrasing, both student and teacher respondents claim that it should be taught in English classes (N=75, 80%, N=31, 82%, respectively), but there is less agreement on whether this skill should

be taught in science classes. 65% of students (N=61) and only 43% of teachers (N=16) claim that it should, whereas 20% of students (N=18) and 46% of teachers (N=17) ‘strongly disagree’ or ‘somewhat disagree’ with the statement (data not shown).

Table 2. The role of English and science lessons in teaching how to reference properly (students N=93, teachers N=38)

I believe that I/my students...		Response				
		I strongly disagree	I somewhat disagree	It is hard to say	I somewhat agree	I strongly agree
...can paraphrase.	students	2%	0%	23%	48%	27%
	teachers	0%	13%	29%	55%	3%
...can quote a fragment from a book/article.	students	0%	3%	6%	35%	56%
	teachers	3%	5%	8%	66%	18%
...can make in-text citations.	students	6%	9%	10%	32%	43%
	teachers	3%	21%	5%	60%	11%
...know the referencing style that is used in the subject they study.	students	2%	13%	38%	25%	22%
	teachers	0%	18%	18%	50%	14%
...can use the referencing style to produce a bibliography.	students	4%	16%	20%	35%	25%
	teachers	0%	18%	13%	61%	8%

5. Conclusions

The results of the questionnaire study revealed that science (biology, chemistry, physics) teachers should play a key role in the process of teaching how to write scientific reports from the linguistic perspective, especially in (i) familiarizing the students with a model report and in directing the students’ attention to (ii) technical vocabulary, (iii) grammar structures typical of a report, (iv) how the section *Background information* is organized and (v) how to organize the section *Evaluation*. Additionally, the conclusion is that while marking scientific reports, science teachers should pay special attention to (i) correcting lexical mistakes and (ii) mistakes in the organization of the sections *Background information* and *Evaluation*.

However, the results proved to be inconclusive for the role of science teachers in correcting grammar mistakes while marking scientific reports. To account for the results one should refer to the formal requirements and assessment criteria of scientific reports as specified by IBO. The assessment criterion *Communication* says that “the necessary information on focus, process and outcomes [has to be] present and presented in a coherent way” (IBO, n.d.) and that the use of subject-specific terminology and conventions should be correct, so it is only natural for students to expect their science teachers to help them with the organization of the report. In addition, the formal requirements hold that students should not be penalized for linguistic mistakes as long as the message is not inhibited, which may explain the inconclusiveness of the role of science teachers in correcting grammar mistakes while marking scientific reports — linguistically confident students may feel it would be a waste of precious time that could otherwise be devoted to improving other areas.

Another conclusion suggested by the results is that there should be a strict cooperation between English and science teachers in the process of teaching the use of referencing styles (except for paraphrasing in science classes, for teachers) as the majority of both groups of respondents claim that the skills linked to referencing (paraphrasing, quoting, making in-text citations and producing a bibliography) should be taught in English and science classes. A possible solution could be that the issues are introduced in English classes and they are practiced in the authentic context of a CLIL science classroom. The explanation of the lack of a need to teach paraphrasing in science classes expressed by science teachers might be that the teachers themselves feel insecure about their language proficiency. The issue of collaboration between language and content teachers was tackled by Snow et al. (1989) where the distinction between content-obligatory and content-compatible language objectives was made.

The research provided a valuable insight into the process of teaching how to write scientific reports; however, it has some limitations. The investigation was only based on one tool, the questionnaire. The use of other methods of data collection would provide other relevant data; for example, as an extension, an interview study together with an analysis of written pieces of students could be conducted. In this way, the scope of the investigation could be broadened and made more detailed. An interview with selected science teachers could focus on the specific strategies that they use while instructing students on how to write scientific reports, whereas the analysis of written pieces could reveal some other formal aspects that need improvement, such as the specific grammar structures that are commonly used, but not yet mastered by students. For this purpose, a genre analysis could be applied (Swales, 1990).

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Appendix: the questionnaire for students and CLIL teachers

Poniższe stwierdzenia dotyczą sprawności językowych (language skills) przydatnych podczas pisania przeglądu literatury (Background information) oraz ewaluacji (Evaluation) sprawozdań z doświadczeń (Lab reports). Dla każdego ze stwierdzeń wybierz cyfrę od 1 do 5 zgodnie z Twoimi odczuciami, gdzie 1 — zdecydowanie nie zgadzam się, 5 — zdecydowanie zgadzam się.

	Zdecydowanie nie	Raczej nie	Trudno powiedzieć	Raczej tak	Zdecydowanie tak
W trakcie uczenia pisania <i>Lab reports</i> , nauczyciel powinien... zapoznać nas z modełowym <i>Lab report</i> .	1	2	3	4	5
zwrócić naszą uwagę na język specjalistyczny.	1	2	3	4	5
zwrócić naszą uwagę na strukturę językowe typowe dla <i>Lab reports</i> (np. bezosobowa forma bierna <i>It is considered ...</i>).	1	2	3	4	5
zwrócić naszą uwagę na organizację sekcji <i>Background information</i> .	1	2	3	4	5
zwrócić naszą uwagę na organizację myśli w <i>Evaluation</i> .	1	2	3	4	5
	Zdecydowanie nie	Raczej nie	Trudno powiedzieć	Raczej tak	Zdecydowanie tak
Kiedy nauczyciel sprawdza <i>Lab reports</i> powinien... zwracać uwagę na błędy językowe w słownictwie.	1	2	3	4	5
zwracać uwagę na błędy językowe w gramatyce.	1	2	3	4	5
zwracać uwagę na błędy w organizacji wyżej wymienionych części.	1	2	3	4	5

Uważam, że w ramach lekcji języka angielskiego uczniowie powinni być uczeni w jaki sposób...	Zdecydowanie nie	Raczej nie	Trudno powiedzieć	Raczej tak	Zdecydowanie tak
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
używać parafraz.					
zacytować fragment tekstu z książki/artykułu.					
wstawiać przypisy tekstowe.					
stworzyć bibliografię.					
Uważam, że w ramach lekcji przedmiotu nauczanego po angielsku (biologia, chemia, fizyka) uczniowie powinni być uczeni w jaki sposób...	Zdecydowanie nie	Raczej nie	Trudno powiedzieć	Raczej tak	Zdecydowanie tak
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
używać parafraz.					
zacytować fragment tekstu z książki/artykułu.					
wstawiać przypisy tekstowe.					
stworzyć bibliografię.					