THE LANGUAGE FOCUS OF SCIENCE EDUCATION INTEGRATED WITH ENGLISH LEARNING

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ABSTRACT: Global education demands being directed to scientific literacy and language proficiency, research on the school integration of Science and English and on the language focus for Science education is highly relevant. One educational approach is CLIL, aiming both at learners' Content and Language acquisition. The main objective of our work – framed in the socio-constructivism and designed as a case study – is to understand what teaching strategies and classroom interactions have been developed and can be promoted in the "English Plus" project in one Portuguese school to support students, when Science education is integrated with English use. Context characterization shows the importance of developing a language-aware teaching approach to improve the subject education and student learning. To foster that, an instrument has been constructed and is presented here.

KEYWORDS: CLIL, Science education, language-focused, English, Portuguese 7th and 8th grades.

OBJECTIVES: To construct a context-derived instrument for investigating on and supervising teacher planning and classroom practices whereby cross-curricular integration between Science and English has been developed, through a content-based language instruction project in one Portuguese school. Aligning with a socio-cultural perspective, the purpose of narrowing the observation on teacher strategies and interactions in classroom is required to triangulate information gathered and to understand the relationship between Science and the language used in/for/with it, useful for teacher practice orientation and student learning support.

THEORETICAL FRAMEWORK

The emphasis given to Science education is far from supporting learners in extending scientific knowledge over facts and formulas, and developing a scientific literacy to understand scientific information and taking responsible decisions about socio-scientific issues (Vieira, Tenreiro-Vieira, & Martins, 2011). Participation in the real world implies people can communicate, effectively and collaboratively. Little attention is devoted to the significance of language in learning Science and of the range of semiotic modes available to the Science teacher and in Science in general, although for many students to learn its language is the greatest difficulty (Wellington & Osborne, 2001). Science must be "talked", read and written (Sanmartí, 2007) – considering the inextricable linkage between language and conceptual development – then a language-focused Science education is justified. A deeper understanding of the role of multiple representations in developing Science knowledge and literacy is required, as much as orienting teacher education and professional practices (Yore & Treagust, 2006).

For participating in the global discussion, being competent in other languages (even though to varying degrees) is fundamental. Global demand for learning (through) English has been increasing, and English becoming compulsory in 2015-2016 since the 3rd grade in the Portuguese education system is an example. It is the language of the international scientific community, technology and multimedia, often assumed in academic curricula, for professional mobility and cultural encounters. CLIL (Content and Language Integrated Learning) emerges as a solution for European citizens to use and learn foreign languages (FL) and is indicated as one strategy to promote plurilingual and intercultural education (Beacco et al., 2010). It shares theoretical underpinnings and methodological concerns with the Canadian immersion in bilingual education, despite some differences as for instruction language or teaching materials (Lasagabaster & Sierra, 2010).

CLIL classes are authentic learning environments to achieve communicative competence in FL through classroom activities (Dalton-Puffer & Nikula, 2006). As shown in different versions of the CLIL lesson planning, students learn the subject and how to use types of language. According to Coyle, Hood, and Marsh (2010), learning and teaching of Content and Language converge in "a dual-focused educational approach". Working in an additional language, consequent teacher awareness of learner linguistic needs, and learning characteristics implied have prompted the development of quality teaching and learning strategies in CLIL-based education (Marsh, 2012). Indeed, studies on classroom practices report that CLIL settings/strategies can improve Science education (Grandinetti, Langellotti, & Ting, 2013), representing a "change agent" and – in being a language-sensitive teaching – a beneficial preparation for Content teachers who deal with heterogeneous learners-speakers (Wolff, 2012).

PARTICIPANTS AND METHODS

Aimed at creating contexts meaningful and collaborative for teaching/learning of both the specific and linguistic subjects, the Portuguese CLIL-type "English Plus" (EP) teacher initiative (Simões, Pinho, Costa, & Costa, 2013) might promote the development of scientific literacy and the subject-specific multimodality for Science knowledge and communication, in both the mother tongue and the FL. Our study has been designed in 2015-2016 as a descriptive-explanatory case study with embedded units (Yin, 1994), constituted by participants involved in the EP project at different times and levels: the English teacher, who started the project in History in 2010 and coordinator of the current implementation of EP Science, and 2 Natural Science teachers (at 7th and 8th grade); 7th and 8th graders participating in EP (theoretical) Science classes and "project hour" on Science through English; 11 high school (3 areas) students who had EP History from 7th to 9th. Data collection has been performed through: teacher and former student semi-structured interview; current student semi-structured questionnaire; non-structured "at-different-degree" participant observation of classroom practices (roughly 1/w, during 5 months), lesson planning and other moments (phone calls, etc.).

RESULTS

The instrument we introduce here has derived from context characterization: preliminary data analysis (content analysis of observation log, descriptive student questionnaire and interviews) shows, through independent evidences, that a language-aware teaching methodology can improve the discipline education and student learning. Older students identify strategies of teacher mediation (scaffolding, interaction, paraphrase) as possible factors facilitating the specific subject learning in a FL. Also students currently involved in EP Science recommend their subject teachers to support learners with greater scaffolding/structuring of lessons and activity diversification, and report some difficulties in aspects (debates,

concept maps, reading and writing, etc.) of Science learning where language(s) are implied (Piacentini, Simões, & Vieira, 2016). On the other hand, interviewing teachers and observing their planning and practices reveal that they acknowledge the importance of language and communication in Science (1 subject teacher) and of English use for it (language and subject teachers); it is still not perceived the role that other modalities of communicating and organizing Science can have for the language development.

The need for constructing a framework, to observe and interpret classroom practices and multiple dimensions through which the language of Science and its communication/representation modalities are developed in the Science discourse (Scott, Mortimer, & Aguiar, 2006) also through English (Escobar Urmeneta & Evnitskaya, 2014; Morton, 2012), during EP (English and Science coteaching) and non-EP (only Science teacher) Science lessons has thus arisen, resulting in the tool below (Fig. 1, A/H): constructed by the researcher under the orientation of CLIL experts, tested during 2 EP and non-EP classes, discussed with the PhD supervisors and presented in one seminar on educational research. It combines conceptual perspectives, modified/integrated for our purpose. The main structure was inspired by the work of Llinares, Morton and Whittaker (2012) to understand the roles of Language in CLIL and different disciplines. Needless to say, an overlap in the information collected through all parts can be noticed but it will help in matching data from diverse angles.

The "Language use in/and Science learning in interaction" tool

Science classroom discourse (Mortimer & Scott, 2003), A

A referential framework for teachers to understand and develop the role of talk in Science classrooms for achieving pedagogical goals.

Science genres and language-based approach (Polias, 2006), B

The Halliday and Martin's model is used for defining the register through field, tenor and mode. Language is the main resource for making meaning and assessing learning.

Science and English co-teaching in CLIL classes (Valdés-Sánchez & Espinet, 2016), C

One of the few CLIL research contributions from the Science (as opposed to Language) education field, on integrated learning between Science and English. Interaction turns will be plotted on it.

Language demands in Science performance of ESL (Bunch, Shaw, & Geaney, 2010), D

Grounded in functional and interactional views of language use, it focuses on learners not having English as a family language. "Science (education) genres" are organized in domains of activity (Veel's taxonomy).

Teacher scaffolding strategies (Escobar Urmeneta & Evnitskaya, 2014; etc.), E

Adapted from the online Fortune's verbal/procedural/instructional scaffolding techniques for Content Based Instruction, columns include contributions from authors who highlight the importance of interactional resources in CLIL classes that teachers should be aware of in scaffolding the student learning of both Content and Language.

Language-focused Science education (Wellington & Osborne, 2001), F

As these authors remark, to convey meaning not only through the verbal language a combination and interaction of other modalities are used, the Science languages integrated in the third column as resources for learning.

5E instructional model in Science education (Bybee, 2015), G

Developed by Bybee in the '80s and designed to promote a constructivist approach to Science education., it may be helpful in "recording" learners' practice during classes.

Researcher contributions, H.

Relevant episode occurrence; classroom representation; etc

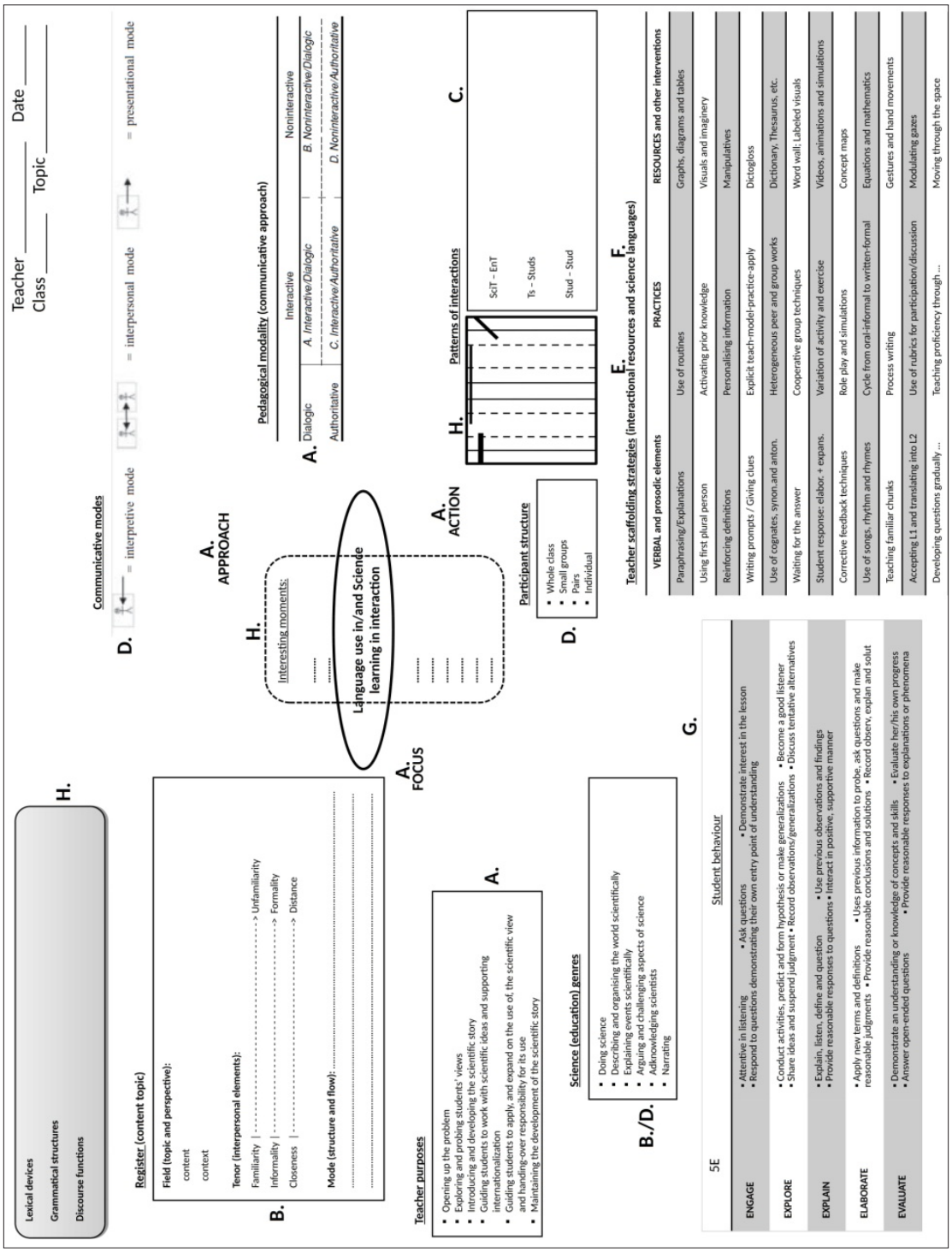

Fig. 1. Research/Teaching instrument

CONCLUSIONS

Due to having an explicit presence of (a foreign) language in the specific subject, CLIL opens a possibility for Content teachers to understand and face the "weight" of language(s) in any curricular topic. Learners dealing with a school language different from the home one have to confront, as any learner does, language demands in disciplines requiring teacher awareness. Students may find difficulties in Science activities involving the use of language and representations; hence their suggestions for teachers to support learning are also related to the way Science knowledge is (re)presented. CLIL may thus be a quality approach for authentic English practice and also a different perspective for Science understanding and contextualization.

The CLIL-type "English Plus" is actually a learning process also for teachers who have a critical approach to their profession, but still need to recognize that Language in Science is fundamental in taking Science education as a learning context for developing literacy beyond classes of students' mother tongue and/or literature. Deriving from characterization of participants, the described instrument offers an opportunity to record and reflect on classroom practices in which Science education is integrated with English use/learning, within this EP programme.

However, more endeavour in our research is required to understand the suitability of English as a language and method for scaffolding Science learning and to refine the tool itself. Further collaboration with participant teachers will be sought – through a focus group and other supervising moments in which to use the above framework – to identify and benefit from issues and strategies pivotal for this educational integration.

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