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Technicality and translanguaging in CLIL biology lessons in Switzerland

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Der folgende Artikel beschäftigt sich mit der Rolle von Fachsprache (technicality) und des Gebrauchs von multilingualen und -modalen Diskurspraktiken (translanguaging) im immersiven Biologieunterricht. Dabei werden vier Episoden aus dem immersiven Biologieunterricht an einem Schweizer Gymnasium qualitativ analysiert. Ziel ist es, zu veranschaulichen, auf welche Art Fachsprache auf lexikalischer Ebene eine Herausforderung im immersiven Biologieunterricht darstellt, abhängig davon ob die Fachbegriffe in der Zielsprache Englisch gleich aufgebaut sind wie in der Schulsprache Deutsch oder nicht. Darüber hinaus soll aufgezeigt werden, dass abhängig davon wie genau Fachbegriffe aufgebaut sind, translanguaging, also der Gebrauch multilingualer und -modaler Diskurspraktiken, eine potenziell bereichernde, wenn nicht sogar notwendige Strategie in der Aushandlung von Fachbegriffen im Unterricht darstellt.

Stichwörter:
multilinguale und -modale Diskurspraktiken, Fachsprache, Immersionsunterricht, Biologie, Schweiz.

Keywords:
translanguaging, technicality, Content and Language Integrated Learning (CLIL), biology, Switzerland.

1. Introduction

Content and Language Integrated Learning (CLIL)[1] programmes are increasing in number and in diversity worldwide, and Switzerland is no exception (see e.g. Gajo et al. 2018). Switzerland then offers a particularly interesting context for the study of CLIL due to its plurilingual situation and its decentralised education system. Science subjects are often marked by a high density of technical terms, which is one of the reasons some teachers are reluctant to teach it in an additional language (Langer & Neumann 2012: 93). Nevertheless, research on the role of these technical terms and how they exactly affect communication in the CLIL classroom has not yet made much progress, especially with regard to the use of multilingual and multimodal resources (translanguaging). Therefore, the present paper attempts to fruitfully combine two particularly relevant concepts in the investigation of CLIL biology lessons – technicality and translanguaging. More precisely, the paper intends to demonstrate that the

[1] Content and Language Integrated Learning (CLIL) is used here as an umbrella term similar to the term "zwei-mehrsprachiger Unterricht", namely as referring to "any type of pedagogical approach that integrates the teaching and learning of content and second/foreign languages" (Morton & Llinares 2017: 1).

encoding of technicality in technical terms is one of the aspects that make scientific concepts difficult for learners to grasp, especially when it is taught in a second or foreign language. In a pilot study (Bieri 2015) on data collected at an upper-secondary school in Switzerland, it was found that the amount of technical terms and the fact that the technical terms in the target language (TL) English did not always coincide with the technical terms in the mainstream language (ML) Standard German[2], was often problematic in the CLIL classes. Bieri (2018), in a qualitative study on the same corpus, further showed that teachers as well as students employ a variety of multilingual resources – translanguaging practices – to deal with technical terms. Particularly striking was the finding that translanguaging involving the source languages (etymological roots such as Latin or Greek) of the technical vocabulary seems to be a useful tool for meaning negotiation. This paper then attempts to expand this finding by illustrating four different translanguaging practices in CLIL biology classes in connection with technicality (Halliday & Martin 1993). First, it aims to show that technicality on a lexical level is a major challenge depending on whether or not it is encoded the same way in the ML and TL. Second, it aims to demonstrate that translanguaging practices might be potentially successful strategies to scaffold the meaning of technical terms in these situations. The paper is structured as follows: it starts with a general introduction to the theoretical framework, outlining the underpinnings of technicality and translanguaging, thereby demonstrating why they are relevant concepts for the study of CLIL biology lessons. This is followed by a brief sketch of the CLIL situation in Switzerland to illustrate the context of the present study. After describing the data and methodology used in the paper, four episodes illustrating the role of technicality and translanguaging in CLIL biology lessons are discussed.

2. Theoretical framework

The main objective and challenge of teaching any subject is the acquisition of content knowledge by building on students' everyday conceptions of the world. This moving between everyday and scientific concepts (Vygotsky [1934] 1986)[3] or horizontal and vertical discourses (Bernstein 1999)[4] has been coined "conceptual change" (see e.g. Treagust & Duit 2008). While this conceptual

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2 The term mainstream language (ML) is used throughout the paper to refer to the default language of instruction in school (Standard German) that is different from the first language (L1) of teachers and most students (Swiss German) in the study. Target language (TL) refers to the language of instruction in CLIL lessons (English in this case).

3 Everyday or spontaneous concepts refer to unconsciously acquired concepts in connection to personal experience, whereas scientific or systematic concepts are those typically learnt in school (see Vygotsky [1934] 1986).

4 Vertical discourses refer to the kind of specific knowledge that is primarily learned through formal education whereas horizontal discourses refer to the everyday knowledge that is learned through participation in local practices with families or friends (see Bernstein 1999).

change from everyday to more scientific concepts may be a general objective of all teaching, it seems particularly relevant in science education where the distance between the two is greatest: "Students come to science lessons with everyday conceptions that differ from the scientific ones they are expected to acquire" (Morton 2012: 101). Technicality – the way scientific understandings of the world are expressed in and through language – is one of the particular difficulties of science discourse that distinguishes it from everyday discourse. This becomes even more challenging in the CLIL context, since

> [i]n CLIL classrooms, as in all classrooms, there is a double 'bridging' process going on. One is between the ideas themselves, from the everyday to the more scientific, and the other is between the two types of language used to talk about these ideas (Llinares et al. 2012: 39.

Even though this "double 'bridging' process" is occurring in all classrooms, it is in the CLIL classrooms where it proves to be particularly difficult. CLIL students (and teachers) are usually second or foreign language learners of the TL. Consequently, this bridging between "the two types of language used to talk about these ideas" becomes increasingly complex. Students may discuss everyday concepts in their L1, but have to use the TL to talk about scientific concepts in the CLIL class. It is, thus, not simply a bridging process between "two types of language" (everyday and scientific), but also between two different languages. In this scenario, the teacher – in order to scaffold scientific concepts – needs to be aware of the conceptual change and the "two types of language" used to talk about it in the respective languages, and employ them appropriately in the CLIL lesson. This is further complicated by the fact that technicality in science might not be encoded the same way in the ML as compared to the TL (Lin 2016: 49). It thus seems that translanguaging – the use of multilingual and multimodal practices – could be a potentially useful tool to negotiate technical terms and its respective scientific concepts. Therefore, in the remainder of this section, I will briefly outline technicality and translanguaging, and their connection to science and CLIL.

2.1 Technicality

According to Halliday & Martin (1993), technicality and abstraction are the two main components of the scientific discourse of any given academic subject. While abstraction – the "moving from an instance or collection of instances, through generalisation to abstract interpretation" (Wignell 1998: 301) – is more relevant in the humanities, it is technicality that marks the discourse of natural or physical sciences (Martin 1993: 212-213). Technicality, then, in Halliday and Martin's sense, encompasses everything that makes language in science technical or specific to a particular scientific field. This involves the very creation or etymology of technical terms but also the function and use of technical language in science discourse in general: "[T]echnical language enables scientists to reclassify the world" (Martin 1993: 212). In other words, technical terms in science are not just a specific vocabulary but encode a different understanding of the world compared to common-sense views:

> It does this by creating a technical language through setting up technical terms, arranging those terms taxonomically and then using that framework to explain how the world came to be as it is (Wignell 1998: 298-299).

Science has often been marked by a high density of technical terms, and Halliday and Martin's concept of technicality is particularly useful because it does not only include a concrete definition of what a technical term is, but also how such a term becomes technical: "Technicality [...] refers to the use of terms or expressions [...] with a specialized field-specific meaning" (Wignell et al. 1993: 144). According to them, for a term to become technical in science two steps are necessary: first, one has to name the phenomenon and second, one has to make it technical by giving it a field-specific meaning (Lin 2016: 50). There are several ways of giving a name to certain phenomena, which, in science, mostly consist of nouns as "the taxonomies they [technical terms] establish in fact organize all phenomena as if they were things" (Martin 1993: 212). Through internal word-formation processes such as nominalizations, for instance, processes like *absorb* can be turned into *absorption* and thus be described as nouns, which in turn facilitates classification and the establishing of taxonomies. Name-giving can also happen externally through borrowing or building on already existing terms from other languages, such as *oxygen* coming from French or *photosynthesis* being a Latin and Greek compound. The second step involves marking a term as technical by giving it a field-specific meaning. That is, a technical term can also be established using an already-existing vernacular and assigning it a particular meaning, such as in *force*[5]. Especially when there is already an existing vernacular meaning of the same term, a technical term needs to be marked as such. In textbooks, this is often done via bold font, or other graphic emphasis on the technical term. In oral interaction – in the classroom for instance – it is then the teacher's task to signal to the students that this is a newly introduced technical term, and "unpack" and "repack" the respective concepts.

This is particularly complex in CLIL lessons, where the teacher has to move between everyday and scientific concepts, and simultaneously between the ML and TL. This is further complicated by the fact that technicality is not necessarily encoded the same way in every language in the respective scientific discourse. For example, some languages have borrowed a large number of terms, whereas other languages allow for more internal word-formation processes, and others again have a higher density of vernacular terms that become technicalized. Hence, there are different ways in which technicality is constructed or encoded in a particular language. Lin (2016: 49) describes the example of *heat* as a

5 *Force* as an everyday word is a synonym for *strength*, whereas in the discipline of physics, *force* refers to any influence which tends to change the motion of an object.

technical term (e.g. in physics) and *hot* as an everyday adjective, which in Chinese are encoded in the same term (熱). Consequently, this has an effect on how Chinese learners learn the concept of *heat* in English as there is no equivalent in Chinese. Similarly, Nikula (2017) describes how Finnish students in a CLIL physics lesson are struggling with the everyday and academic meaning of *moment.* This might be due to English using the same term *moment* to refer to the everyday but also the field-specific meaning in physics, whereas Finnish employs a different term for each. Both, Chinese (as a Sino-Tibetan language) and Finnish (as a Uralic language) are topologically and thus structurally very different from English – hence, it seems logical, to some degree, that they have not only developed different ways of conceptualising the world, but also various forms of encoding technicality in their language. However, as this paper is going to illustrate, even in more closely related languages such as German and English (both Germanic languages) technicality can be an issue.

2.2 Translanguaging

Translanguaging has received a lot of attention recently, with regard to science education (e.g. Karlsson et al. 2019) as well as CLIL (e.g. Moore & Nikula 2016). It refers to the use of a speaker's full linguistic, semiotic and modal resources to transmit any kind of information (Li Wei 2018). Translanguaging thus posits that any speaker – whether s/he is labelled as a mono-/bi- or multilingual – has one repertoire of features (linguistic and otherwise) that s/he can employ freely and strategically to convey meaning (Vogel & García 2017). Despite its current popularity, translanguaging is not undisputed (see Auer 2019 for an overview of recent criticism). Some advocates of translanguaging (e.g. Otheguy et al. 2018) have gone as far as marking it as a new theory of bilingualism, thereby dismissing much of the scholarly work that has been done on well-established concepts such as code-switching (claiming language does not work in so-called codes). The view taken in this paper sees translanguaging as neither mutually exclusive nor synonymous with related concepts such as code-switching, but as an umbrella term. To briefly illustrate this: the most common translanguaging practice in CLIL with regard to subject-specific language consists of translating key terminology, such as in the example (1) (taken from Bieri 2018: 95).

(1) T: Airways are enforced by **rings of cartilage,** "Knorpelspangen".

In example (1), the teacher introduces the term in question, and then automatically provides the ML equivalent thereby drawing on a more familiar resource to ensure mutual understanding. This is a perfect example of what has been called code-switching for interpreting (Auer 2019: 13). However, taking the different encoding of technicality in different languages into account, there might not always be an exact equivalent of the term in question, hence the strategy of simply translating key terminology does not always work. Instead, teachers might have to use circumlocution, or resort to other translanguaging practices to achieve mutual understanding. Imagine, for instance, a teacher wanting to explain the concept of *photosynthesis* to her students. She might first give a verbal explanation. If it is a CLIL class, she will do this verbal explanation in the TL that is probably neither her nor the students' L1, and might from time to time use terms or expressions from the L1 or other languages known by the students to support her explanation. She uses all her linguistic resources in her attempt to make students understand the concept. She could, however, equally well underline her explanation with gestures describing how plants get energy from sunlight (semiotic resource), or draw a sketch on the blackboard (modal resource). In the end, she uses all resources available to her in that moment to negotiate and scaffold the meaning of the scientific concept *photosynthesis*. Translanguaging seems more suitable to describe such practices because it encompasses all kinds of resources – including code-switching – used for communication in a certain situation. Therefore it appears worthwhile to look at translanguaging practices and their connection to the negotiation of technicality in a CLIL setting such as the present one, where multiple languages on various levels are simultaneously at work: the individual linguistic repertoires of students and teachers (Swiss German or other L1s), the ML and TL (Standard German or English), and the languages present in the technical vocabulary of biology (Greek, Latin and others).

3. CLIL in Switzerland

In Switzerland, the context of the present study, we find a complex multilingual linguistic situation like in many parts of the world. There are four official languages (Standard German, French, Italian and Romansh), and a spoken language (Swiss German) that exists in many regional varieties and differs considerably from Standard German. Due to increasing immigration and globalization, more than one fifth of the Swiss population has an L1 other than the four official languages (BFS 2017: 32). Further, Switzerland has a decentralised education system, meaning it consists of a confederation with 26 cantons and the federal government as the highest political authority. All cantons have their own constitution, are largely autonomous, and responsible for organising their own compulsory education system.

Since there is no national curriculum, language education can vary considerably among cantons. There are also no exhaustive CLIL programmes during compulsory education. Those schools that employ CLIL implemented it mostly based on individual initiatives (e.g. "Schulprojekt 21", see Büeler et al. 2010). The only form of CLIL implemented nationwide is called "zweisprachige Matur" (bilingual baccalaureate) and can be found at the *Gymnasien* – upper-secondary schools. After compulsory school, pupils can, based on achieving good marks, attend an upper-secondary school (grades 10-14) where they obtain the federal baccalaureate, the official certificate needed to enter university. In 2012, more than 70% of upper-secondary schools offered the bilingual baccalaureate (SKBF 2014: 150), a number that has likely increased to date. The most common form of the bilingual baccalaureate is found in the German-speaking part with Standard German as ML and English as TL (Elmiger et al. 2010: 34; SKBF 2018: 143). The data presented in the following section comes from such an upper-secondary school that offers the bilingual baccalaureate in its most common form, with ML Standard German and TL English.

4. Data and methodology

This paper draws on data from a larger project investigating and comparing the discursive practices in CLIL (English) and non-CLIL (German) biology lessons at an upper-secondary school in German-speaking Switzerland (Bieri 2015, 2018). The data consists of 31 video-recorded biology lessons taught by two teachers teaching their subject both in the TL English (CLIL) and in the ML Standard German (non-CLIL). All students are in grade 10 or 11, and between 16-18 years old. Both teachers and most students are non-native speakers of English and have Swiss German as their L1. The data presented here focus only on the CLIL lessons of the above-mentioned corpus. All transcribed instances of teacher-whole class interaction involving translanguaging occurring in the 16 CLIL lessons were analysed. Since the aim of this paper is to illustrate how translanguaging is used when technical terms are encoded the same way in the ML and TL as opposed to when they are not, the questions below were used for further selection of episodes:

a) In which instances does technicality pose a potential problem?

b) Do the ML and TL share the same technicalizing process or not?

Based on these questions, the following four episodes were chosen for more detailed analysis (Fig. 1):

Episode	Class	Technical term in question (TL/ML)
1	CLIL_2e_20150521[6]	Affinity/Affinität
2	CLIL_1b_20151518	Dendrochronology/Dendrochronologie
3	CLIL_2e_20150521	Chemical equilibrium/chemisches Gleichgewicht
4	CLIL_1b_20150528	Peanuts/Erdnüsse

Fig. 1: The four selected episodes

6 "CLIL_2e_20150521" means that excerpt 1 is taken from a biology lesson in English (CLIL), of class 2e on the 21st of May 2015. All subsequent excerpts are labelled accordingly.

5. Analysis and discussion

This section presents the findings and discussion of the four selected episodes. They have been divided into whether they employ the same technical term in the TL and ML, as is the case with *affinity* (Section 5.1.1) and *dendrochronology* (Section 5.1.2), or not, as is the case with *chemical equilibrium* (Section 5.2.1) and *peanuts* (5.2.2).

5.1 Same encoding of technicality

5.1.1 Affinity – Affinität

Affinity is a term derived from Latin *affinitas* (kinship), and refers, in chemistry, to "the tendency of a molecule to combine or form a bond (of any kind) with another" (OED 2019). The same technicalizing process took place in the German language, thus the technical term used in Standard German *Affinität* is also derived from Latin. In the following episode, the teacher is explaining oxygen transport. Previously in that lesson (not included in the excerpt) he introduces the technical term affinity as: "Affinity means basically the endeavour of that molecule you go to attract oxygen". Thus, from a perspective of technicality, the teacher marks the term as technical by naming it and then giving it a field-specific meaning, i.e. setting it up as technical. After that short definition, however, the teacher seems to assume that affinity is an established term, and continues to use it as such. Only later in the lesson, as excerpt (1) below shows, does it become evident that the concept of affinity is not yet clear to the students.

(1) "Affinity" CLIL_2e_20150521

01	S1:	What means uhm **affinity**?
02	T1:	"Begehren"? Uhm (3.5) you can also call it just call simply call it uhm (.) love for oxygen (.) I mean it really is or eh uhm
03		(6.0)
04	T1:	anybody have a better word for that?
05	S2:	**Magnet**?
06	T1:	Pardon?
07	S2:	**Magnet**?
08	T1:	**Magnet**
09	Ss:	No?
10	T1:	Well you will see soon why magnet is not really appropriate ((pointing to the screen))

In line 01, a student asks about the exact meaning of affinity. In this case, the teacher cannot just provide the equivalent in the ML, as the technical terms are exactly the same in the TL and ML. He therefore uses a German equivalent of a more everyday term, *Begehren* (desire). He additionally reiterates the already explained concept by paraphrasing it as "love for oxygen". However, the long break (6 seconds) in line 03 suggests that he is struggling to come up with any other equivalent or circumlocution for the concept in question. He then asks his students whether they might have better alternatives (line 04). S2 suggests "magnet" (line 05) as an alternative, which the teacher evaluates as "not really appropriate" (line 10). While saying that, he points to the PowerPoint slide depicting the saturation curve of haemoglobin, as if this were an explanation as to why the term *magnet* is not an appropriate alternative. At the end of this very lesson, the teacher once again asks the class whether they have now understood the concept of affinity. The class overwhelmingly responds with a "no" and soon after that, the lesson is over. This means that contrary to what the teacher promised, namely that the students will soon see why affinity is not like a magnet, he eventually fails in explaining this concept or showing how it is actually different from a magnet.

5.1.2 Dendrochronology – Dendrochronologie

A strategy to deal with technical terms that are identical in the TL and ML is to draw on their common etymology. This seems particularly effective in technical terms that are formed through compounding, and can thus be deconstructed into their individual components. In excerpt (2), the teacher deconstructs the term *dendrochronology,* or *Dendrochronologie* in the ML, into its individual components, thereby co-constructing the meaning of the term itself with his students. For this, he translanguages with the source languages of the word, in this case Greek. He introduces the term itself early on in the lesson in connection with a worksheet where the students have to date trees based on their annual rings. Even though the students know that what they are doing is called *dendrochronology,* the teacher comes back to the term in excerpt (2).

(2) "Dendrochronology" CLIL_1b_20151518

11	T2:	**Dendro** could you know the word **dendro**? Probably not(.) **Dendro** is a "tree" ((writing "tree" on OHP, 8.0)) **Chronos** (.) that's a word you might know **chronology-** of **chronology** (4.0) One who (has not) spoken before, Sarah[7]?
12	S1:	(xx)
13	T2:	It's not exactly no (.) a **chronometry** that's if therefore what is chr- what we call a "stopwatch" (.) was originally called a **chronologer** (.) yes?
14	S2:	"Time"
15	T2:	It's "time"(.) "time", yes ((writing "time" on OHP, 4.0))

In excerpt (2) the teacher starts with explaining the first component of the technical term *dendro* by translating from the source language Greek to English. He then writes *dendro* with its corresponding meaning "tree" on the overhead projector (OHP). With that, the teacher updates what he calls a "foreign word list", a list he keeps with all his biology classes, where they collect common recurring Latin or Greek pre- and suffixes of technical terms. At the end of line 11, the teacher shifts to the second constituent of *dendrochronology, chronos.* Instead of simply translating the word in question, he draws on a word that has *chronos* in it, and that might be more familiar to students – *chronology.* Unfortunately, the student's answer in line 12 is unintelligible, but deducing from the teacher's evaluation in line 13, it does not seem to be the right answer. The teacher tries again by drawing on other related words such as *chronometry* and

7 Names of participants have been changed in order to preserve their anonymity.

chronologer, adding that the latter used to be a term for a "stopwatch". S2 then provides the correct answer in line 14, concluding that *chronos* means "time". The teacher positively evaluates that answer and writes down "time" as corresponding to *chronos* in his word list on the OHP (line 15). Due to this word list, the students already know the meaning of *logy* or *logos,* "the study of", meaning the students can now put together the individual parts of the compound *dendrochronology* as referring to "the study of time in trees". Which is exactly what they were doing, calculating dates based on trees' annual rings. This is an excellent example of unpacking, scaffolding and repacking of a technical term. First, the technical term is deconstructed into its individual components, then the meaning of each individual constituent is either already known to the students (*logy),* provided by the teacher himself *(dendro*), or scaffolded so students can construct the meaning of *chronos* based on their own knowledge of more familiar concepts as *chronology, chronometry* or *chronologer.* The example of *chronos* further shows that technicality is a recursive process:·

> the technicality, once established, can be used to create further technicality, which can then be used to explain and can then be used to set up further technicality and so on (Wignell 1998: 299).

Thus, in the above-mentioned examples the technical terms are encoded exactly the same way in the TL and the ML, i.e. they share the same etymology, and the teacher has to use strategies other than simple translation to ensure mutual understanding. Two of these strategies were illustrated in the above-mentioned episodes: drawing on a more everyday word of the concept (excerpt 1) and translanguaging with the source languages (excerpt 2). There are other technical terms that are encoded the same way in the ML and TL without sharing the exact same name or etymology, i.e. when they have literal equivalence. This, for instance, is the case with example (1) in Section 2.2, where the teacher introduces the term *rings of cartilage* and immediately provides the ML translation "Knorpelspangen". Here, *cartilage* corresponds to "Knorpel" and *rings* to "Spangen". In such a situation, it mostly suffices when the teacher simply mentions the ML equivalent. Technicality can, however, be an equally challenging concept when it is not encoded the same way and there is no direct or literal equivalent in the ML or TL, as will be shown in the following sections.

5.2 Different encoding of technicality

5.2.1 Chemical equilibrium – chemisches Gleichgewicht

In this lesson, the class is discussing the concept of chemical equilibrium: "a state of dynamic balance in a reversible chemical reaction when the reaction velocities in both directions are equal" (Cammack et al. 2006). In other words, any chemical reaction can reach a state of equilibrium, where it seems as if no reaction is happening at all, but the reaction and reverse reaction are simply in balance. In excerpt (3), the teacher introduces the concept of *chemical equilibrium* with the term "balance of the equation" (line 16), asking whether one of the students could explain why the equilibrium resides on the right and not on the left side. He underlines his explanations by pointing to the PowerPoint slide depicting the chemical reaction in question. The student (line 17) replies, but struggles to find the right the word in English for *equilibrium*, as indicated by the hesitation marker "uhm" and a small pause, before using the ML term "Gleichgewicht". The teacher provides the student with the respective translation *balance* (line 18), which the student readily incorporates in his answer (line 19). The question mark at the end of line 18 shows that the teacher raises his intonation at the end of the word, which might indicate that he himself is not that sure about the translation.

(3) "Equation balance" CLIL_2e_20150521

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16   T1:   Now question why is the why does the balance of the equation
           reside on the right-hand side ((pointing to the chemical reaction
           on PPP slide)) (.) so there's a big arrow ((pointing to the arrow
           on PPP slide)) pointing towards the right and a small arrow
           pointing towards the left (.) Jeremy?
17   S:    Well I don't know how but uhm the big arrow it just shows that
           they uhm (.) "Gleichgewicht"?
18   T1:   Balance?
19   S:    The balance of the reaction is on the right side
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It is exactly this translation that is particularly interesting with regard to technicality. While *balance* is undoubtedly an accurate translation of *Gleichgewicht,* it is not the appropriate translation in this particular situation. While *balance* refers to the everyday meaning of something or someone being balanced, it is *equilibrium* that is used in English scientific discourse as a technical term to describe the balanced state of chemical reactions. In German scientific discourse, however, the term *Gleichgewicht* is used for both, in its everyday meaning equivalent to *balance*, but also as a technical term in chemistry, such as in *chemisches Gleichgewicht* (chemical equilibrium) or *Gleichgewichtsreaktion* (equilibrium reaction). Following excerpt (3), the discussion between the teacher and his class continues, with the teacher repeating "balance of such an equation" and even explicitly explaining the concept of *balance* (excerpt 4):

(4) "Equation balance" CLIL_2e_20150521

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20   T1:   Balance always meaning that there is more reaction going from
           this side than the other way around
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Based on the transcripts from the rest of this lesson, it seems though that the teacher is able to explain how a chemical equilibrium works (students seem to actually comprehend the concept) using all kinds of semiotic (gestures), modal (PowerPoint) and linguistic resources. However, he does so using the incorrect technical terminology. This example illustrates well the difficulty with regard to technicality, when in one case (ML) it is constructed from an everyday term, whereas in the other (TL) the technical term derives from Latin[8]. In such cases,

8 *Equilibrium* is a compound derived from Latin: *aequus* (equal) + *libra* (balance) (OED 2019).

teachers need to be aware of the different technicalizing processes in the respective languages in order to be properly able to explain the concepts with the correct technical terminology.

5.2.2 Peanuts – Erdnüsse

This next episode shows the extent to which translanguaging and technicality are intertwined, and how the former can be successfully used to negotiate the latter.

(5) "Peanuts" CLIL_1b_20150528

21	T2:	**Peanuts** "Erdnüsse" think of the German name "Erdnüsse" (.) Well uhm this is (.) all the also the (.) the English name **peanuts** **pea** is correct it belongs to the family of of **peas** ((pointing to PPP slide))(.) of beans (.) but **nuts** is incorrect these are not **nuts** **peanuts** are not **nuts** (.) And in German "Erdnüsse" "Erd" **earth** is correct because they (.) live (.) ((hand gesture towards ground)) they grow underground but of course **nuts** "Nüsse" it's not good ja
22	S:	So **peanuts** in German should actually (be called) "Erd-" "Erd-"
23	T2:	"Erderbsen" ja ((Ss laughing))
24	T2:	Something like that or "Erdbohnen"

In excerpt (5) the teacher is explaining what peanuts are. Most of us know peanuts as a snack. From a botanical point of view, however, peanuts represent a specific plant genus (Arachis). The teacher goes on to explain that *peanuts* in the TL as well as *Erdnüsse* in the ML are misleading from a scientific perspective, as they imply associations that are not in line with scientific understanding. Here again, same as in excerpt (2), the teacher deconstructs both terms (TL and ML) by looking at their individual components. *Peanuts* is a compound of *pea* and *nuts,* whereas *Erdnuss* is a compound of *Erd* (earth) and *Nuss* (nut). Botanically, the first part of both components is true, in that *peanuts* actually belong to the family of peas, and they do grow underground. However, the teacher stresses that in both terms the second component *nuts* is technically wrong, as peanuts have nothing to do with the botanical category of nuts. This is important with regard to technicality, as it shows that our common-sense taxonomies based on the name itself do not necessarily have to match scientific taxonomies (in this case botanical taxonomies of peas, beans and nuts). The student in line 22 then, taking up the teacher's explanations, attempts to construct a technically correct term in the ML, which the teacher then completes with the linguistic creations of *Erderbsen* (earth peas) and *Erdbohnen* (earth beans).

In the examples mentioned above, the technical terms are differently encoded in the ML and the TL. In the episode on *chemical equilibrium* (excerpts 3 + 4), the ML Standard German has technicalized an everyday term *Gleichgewicht* and assigned it a field-specific meaning (*chemisches Gleichgewicht*). This is not the case in the TL English, where the technical term *equilibrium* derives from Latin and is thus different from the everyday word *balance.* As we have seen, this leads to a scenario where the teacher is able to explain the concept of *chemical equilibrium*, but does so using the wrong terminology. In the last episode discussed here (excerpt 5), the teacher shows the students how their everyday understandings of technical terms relate to the respective scientific taxonomies of that field. By deconstructing the technical terms in both, the TL (*peanuts*) and the ML (*Erdnüsse*), he highlights how these terms became technicalized in the respective languages.

6. Conclusion

This paper has demonstrated the value of investigating CLIL biology lessons through a combined technicality and translanguaging lens. The qualitative analysis of four episodes has highlighted four practices involving translanguaging when dealing with same or different encoding of technicality. If the TL and the ML share the technicalizing process of a technical term, the teacher cannot simply translate the term in question but might use a more everyday term in the ML (*affinity*) or use translanguaging with the source languages of the technical vocabulary (*dendrochronology*). If the TL and ML do not share the same technicalizing process, the unaware teacher might end up using the wrong terminology in the TL based on a literal translation from the ML (*chemical equilibrium*). Being aware of the different encoding, the teacher can also highlight how terms have become technicalized in the TL and contrast it with the ML, thereby switching smoothly from everyday meaning of the term to the scientific one (*peanuts).*

When it comes to the role of translanguaging in these episodes, one observation is worth mentioning: In episodes 1 (*affinity*) and 3 (*chemical equilibrium*), the teacher translanguages spontaneously as a reaction to student initiations. In both cases, translanguaging does not seem to contribute much to successful negotiation of the terms in question. In episodes 2 (*dendrochronology*) and 4 (*peanuts*), the teacher appears to have pre-planned the use of translanguaging to purposefully negotiate the technical terms. In these episodes, it looks like the students have no problem grasping the meaning of the technical terms in question. Thus, translanguaging seems to be a potentially successful tool to negotiate technicality if it is consciously implemented. Therefore, CLIL science teachers need to be made aware of the technicalizing process of key words so they can "show how a term has become technicalized in a specific discipline" (Lin 2016: 50) in the respective language. Further research should explore whether translanguaging can be a successful strategy to negotiate technical vocabulary in other CLIL subjects as well, especially in the humanities, where abstraction and not technicality complicates scientific discourse.

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Appendix

Transcription conventions

Transcription conventions are an abridged and adapted version of Dalton-Puffer (2007: xi-x), itself based on Markee (2000: 167-168).

Identity of speakers

T	teacher
S	unidientified student
S1, S2	probably student 1, student 2
Ss	several or all students simultaneously

Characteristics of speech delivery

(.)	short pause
(5.0)	long pause (timed in seconds)
?	rising intonation, not necessarily a question
no-	a hyphen indicates an abrupt cut-off

Commentary in the transcript

((laughs))	comment about actions
(x)	indicates an unintelligible word
(xx)	indicates a stretch of talk unintelligible to the researcher
(founder)	indicates an unclear or probable item
what **is** this?	bold font shows material which is currently under discussion

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