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DIPLOMARBEIT

Titel der Diplomarbeit

„Communication and Interaction in Content and
Language Integrated Learning (CLIL) Classes in Physics

A Theory-based Analysis of Classroom Practice in Austrian Schools“

Band 1 von 1

Verfasser

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Magister der Naturwissenschaften (Mag.rer.nat.)

Wien, 2012	
Studienkennzahl lt. Studienblatt:	A 190 344 412
Studienrichtung lt. Studienblatt:	Lehramtsstudium Englisch, Physik
Betreuerin / Betreuer:	Univ.-Prof. Dr. Martin Hopf

Teaching is only demonstrating that it is possible.
Learning is making it possible for yourself.

– Paulo Coelho, *The Pilgrimage*

Acknowledgements

Bringing this thesis to its completion
closes a chapter of my life marked by insight, growth, and amazement.

Looking back, I realise all of this would have not been possible without
the constant, competent and valuable guidance of my advisor,
the resources provided by my parents, and
the loving, invaluable support and understanding of my partner.

Not only would I like to express my gratitude and respect for these exceptional
people but I would also like to thank all the teachers, students and
administrators of the participating schools for their readiness to participate, their
flexibility and patience.

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Abstract

European Content and Language Integrated Learning (CLIL) programmes have been receiving great praise for their positive impact on student motivation and learning outcomes and are quickly growing in popularity and spreading all across European schools. While experts generally agree on the positive impact that CLIL instruction is said to have on the learners' language competence, potential benefits for content learning are still subject of current research. Research on the topic of CLIL seems in general to focus on aspects related to language instruction, still, literature provides a great number of recommendations and guidelines for providing successful CLIL instruction in the area of science teaching.

This work is aimed at analysing CLIL practice in Austria against two research questions. Firstly, it will be analysed to which extend these aforementioned recommendations and guidelines are mirrored in actual classroom practice, secondly, and as this kind of instruction is potentially governed by different communicative and interactive structures, an investigation of these structures seems indicated. Here, the concept of Negotiation of Meaning, which has been said to play a pivotal role in language and content learning, is central to the study.

For this investigation, 14 CLIL Physics lessons with different teachers and in different schools have been videotaped and assessed through low and medium inference coding and through high inference analysis methods. Additionally, interviews with the involved teachers were carried out and analysed.

It is found that, while some of the recommendations and guidelines, such as providing the students with a wide range of support strategies, can be found in actual classroom practice, others, such as lesson time dedicated to explicit language learning are only partly met. Negotiation of Meaning can be found more frequently in settings where students have a greater possibility to interact with the teacher and in lesson phases where previously presented content is summarised or revised.

Zusammenfassung

Fremdsprachenintegrierter Sachfachunterricht (Content and Language Integrated Learning - CLIL) erfreut sich an einer stetig wachsenden Anzahl Europäischer Schulen immer größerer Beliebtheit. Während die Vorteile integrativer Unterrichtsformen für die Entwicklung von Fremdsprachenkompetenz mittlerweile außer Frage stehen, sind mögliche Synergieeffekte für den Fachunterricht nach wie vor Gegenstand aktueller Forschungstätigkeit. Im Allgemeinen scheint das Konzept fremdsprachenintegrierten Fachunterrichts bevorzugt von Seiten der Spracherwerbsforschung Beachtung zu finden. Nichtsdestotrotz existiert eine große Menge an theoriebasierten, wenn auch nicht empirisch belegten, Vorschlägen zur erfolgreichen Gestaltung fremdsprachenintegrierten Naturwissenschaftsunterrichts.

Die vorliegende Arbeit beschäftigt sich mit der Analyse von englischsprachig geführtem Physikunterricht an Wiener Gymnasien vor dem Hintergrund zweier Fragestellungen. Zum einen soll untersucht werden, wie und zu welchem Erfolg die diversen Vorschläge und Empfehlungen aus der Literatur in der Praxis Umsetzung finden, zum Anderen erscheint, ausgehend von der Annahme, dass in fremdsprachlich geführten Unterrichtsszenarien andere Kommunikations- und Interaktionsmuster als im Regelunterricht vorherrschen könnten, eine Untersuchung eben dieser kommunikativen Strukturen angebracht. Dabei nimmt das Konzept der Bedeutungsaushandlung, welchem bereits entscheidender Einfluss auf Lernprozesse zugesprochen wurde, eine zentrale Rolle ein.

Für die Untersuchung wurden 14 englischsprachig geführte Physikstunden an drei unterschiedlichen Wiener Schulen bei fünf unterschiedlichen Lehrkräften in Bild und Ton aufgezeichnet und mittels niedrig bis mittel inferenter Kodierungs- und hoch inferenter Analyseverfahren ausgewertet, zusätzlich wurden mit den betroffenen Lehrkräften Interviews geführt und ausgewertet.

Es lässt sich erkennen, dass einige Empfehlungen aus der Literatur, wie etwa das Einbinden expliziter Sprachlernphasen nur bedingt Umsetzung in der Praxis finden, während sich andere, wie etwa die Verwendung diverser Unterstützungsstrategien auch im tatsächlichen Unterricht widerspiegeln. Bedeutungsaushandlungen kommen häufiger in Phasen, in denen Schülerinnen und Schülern Möglichkeit zur verstärkten Teilnahme am Unterrichtsgespräch eingeräumt wird, sowie in Phasen in welchen bereits Gelerntes zusammengefasst oder wiederholt wird, vor.

1 Introduction

1.1 Content and Language Integrated Learning

European schools have a long tradition of teaching subject matter in a language different to the students first language (L1) in a broad range of contexts and for a multitude of reasons. Naturally, a host of different trends, approaches and practices has developed over time. The same is true for terminology, with such practices and programs being labelled differently in different countries, or given different labels denoting finer distinctions in their approaches. For the sake of simplicity, in this paper the -most common- label of *Content and Language Integrated Learning* (CLIL) is used exclusively and defined rather broadly taking up the definition offered by Marsh, who defines CLIL as

any dual-focused educational context in which an additional language, thus not usually the first language of the learners involved, is used as a medium in the teaching and learning of non-language content. (2002: 15)

CLIL, as will be discussed, is a highly promising and potentially powerful means of instruction, but at the same time also highly complex and challenging for learners and teachers alike. With this thesis, I hope to be able to make a valuable contribution to the body of knowledge which has been built up around the concept and help sensitise CLIL teachers and prospective CLIL teachers to some of the more subtle dynamics of classroom interaction and provide recommendations helping them planning, designing and carrying out their lessons accordingly.

1.2 Motivation and aim

The growing amount of CLIL instruction in European schools (compare section 2.2) makes it worth a focussed analysis, especially as it is a topic that, from my own experience is, if at all, only rather superficially treated in university teacher training, but at the same time not uncommon to Austrian lower and upper secondary education. Additionally, as a student and teacher trainee for the subjects of English and Physics, I naturally have developed a special interest in this topic as it encompasses both of my rather contrasting, and difficult to combine, subjects.

The primary aim of this thesis is to give a broad overview on typical recommendations and guidelines for successful and effective CLIL practice, and analyse through a small-scale case study how these recommendations are put to practice by Austrian CLIL teachers.

Another, equally important, goal is to analyse communicative and interactive patterns in Austrian CLIL lessons against the background of expert literature. Special attention is given to the concept of Negotiation of Meaning, which - as will be shown - might play a pivotal role in the progress of teaching, understanding and learning especially in CLIL classes.

This is achieved through a thorough literature review and a small-scale case study for which 14 CLIL lessons in different classes, schools and with different teachers have been recorded and analysed through various means. The recorded data and its analysis have built up a considerable amount of data, providing a solid basis for an interesting discussion on various aspects of CLIL teaching, communication and interaction, and from which some, albeit only normative, implications for CLIL practice can be deducted.

2 Literature review

2.1 Proposed benefits of CLIL

The wide spread and rapid growth of European CLIL programs (Marsh 2002: 91f; EACEA Eurydice 2008: 40) implies that the concept seems to be generally accepted very positively by teachers, parents, students and policymakers throughout Europe. Of course, while its mere popularity cannot alone be considered an indication for its being advantageous to regular instruction, one can still conclude that there must be a number of potential benefits to be gained from such an approach. As will be seen in this section, almost all scholars indeed agree on many of the positive impacts CLIL instruction is said to have on learning outcomes and student motivation.

2.1.1 *Benefits for language learning*

One of the most important benefits of CLIL is that language learning takes place in an authentic, naturalistic environment, which is one of the most important goals in the communicative language teaching model (CLT, for a detailed account see for example Hedge 2008) and therefore highly favourable. Dalton-Puffer (2007: 8), for example, is convinced that CLIL "creates conditions for naturalistic language learning" and that it is a form of "learning the language in the street". Brinton et al. (2008: 2) agree and add that this authenticity is achieved by taking the "content as the point of departure", which results in the target language shifting from the subject of instruction to its medium, as Otten & Wildhage (2007: 18) point out. This notion is mirrored in Dalton-Puffer's (2007: 8) claim that the focus of a CLIL classroom is rather on meaning than on form.

There is, however some controversy regarding the development of the individual language skills through CLIL classrooms. While Brinton et al. (2008: 2) claim that, because CLIL is a form of highly authentic language learning, it affects receptive (listening and reading) and productive (speaking and writing) language skills equally, Grabe & Stoller (1997: 6) do not support this view and present data from a study which suggests that CLIL classrooms only aid the development of receptive skills but leave the latter mostly unaffected.

Another aspect which scholars do agree on is the importance of language and communication skills for international work and studies. Finkbeiner & Fehling (2002: 5) stress this importance in pointing out that multilingualism has become a key competence especially in the multicultural Europe of today. Otten & Wildhage (2007: 12) add that most parents also share this view and therefore welcome CLIL courses for their children.

Furthermore, and although quite obvious, some scholars, including Dalton- Puffer (2007: 8), explicitly mention that there are actually two forms of instruction, one might even say two subjects, the language and content instruction, taking place at the same time in CLIL classrooms, which could be considered not only time saving but also more efficient than regular instruction.

From observations in classrooms, interviews with students and teachers and related studies, many scholars deduct that students show much higher motivation in language learning compared to regular language instruction and achieve better results. Otten & Wildhage (2007: 12), for instance, present results from interviews with European teachers who report significant increases in motivation and language competence in their learners. Brinton et al. (2008: 3) suggest that this might result from the learners perceiving the language use as more relevant than in regular language instruction. Dalton-Puffer (2007: 9) even adds that CLIL classes tend to reduce student's anxiety in using the target language.

Support for the concept of CLIL can not only be taken from the study of classroom practice but also from other scientific fields as well. Grabe & Stoller (1997: 8-13), for instance, draw a number of interesting implications from the field of educational sciences as well as educational and cognitive psychology. Most other scholars, however, make use of concepts from the subject area of second language acquisition, the most common of which in the context of CLIL is Krashen's (1982: 20ff) *Input Hypothesis*. Krashen assumes that language is (passively) *acquired*, as opposed to (actively) *learnt*, when "comprehensible input" is provided to the learners. He defines this comprehensible input as "language that contains structure that is 'a little beyond' where [the learners] are now" (Krashen 1982: 21). And in fact, in his *Introduction to the Internet Edition* (2009) Krashen claims that subsequent research has confirmed his hypothesis on many levels. One might argue that CLIL classes, if planned and conducted well, are perfectly conforming to the theory's demands for comprehensible input (compare Brinton et al. 2008: 3).

From what has been said so far, the beneficial value of CLIL instruction for language learning seems to be tremendous. In fact, not only does the concept of CLIL, as has been discussed, perfectly match modern views of second language instruction for a number of reasons, but also is this additional value well documented by numerous studies, many of which are sketched in Haagen-Schützenhöfer et al. (2011: 229f), who, in summarising and comparing these results, conclude that the learners' language competence can be shown to

improve significantly through CLIL instruction. Those areas which are affected by CLIL instruction the most are vocabulary and range, especially in connection to technical terminology, as well as communicative competence.

2.1.2 Benefits for subject learning

While various advantages for language learning through CLIL instruction are well researched and documented, there is, still, considerable lack of empirical research on the effects of CLIL on the learning outcomes in respect to subject matter, as Haagen-Schützenhöfer et al. (2011: 232) point out, nevertheless, there are a number of studies based on questionnaires, interviews, student performance tests and the like which all seem to suggest that while no significant benefit might be gained from CLIL instruction, there are also no considerable disadvantages to be made out. In other words, even if CLIL instruction were to have no positive effect on subject learning at all, at least no indication is to be found for any detrimental effects the use of a foreign language might have.

Despite these tendencies, there are still a number of possible benefits for subject instruction which have been suggested and discussed by various researchers. Bonnet (2004: 20), for instance, states that from his personal experience, in CLIL classes instruction as well as thinking processes tend to be slowed down on purpose because of the additional challenge the foreign language poses, allowing for a deeper processing of the content. Pirner (2007: 47) has made the same observation in one of his studies and also mentions (2007: 50) that it is not only the students who experience the foreign language as more challenging, but also the teacher, especially if they enjoyed no special language training themselves (after all, CLIL teachers do not necessarily also have to be language teachers), leading to their investing more time and thought into preparation of CLIL lessons than they would normally. However, none of these have been empirically attested so far and therefore remain speculation based on personal observation.

A recent study by Haagen-Schützenhöfer et al. (2011: 251f) was aimed at generating sound empirical data for further discussion on the topic. The researchers compared the learning outcomes, with respect to subject performance, of a series of pre-fabricated lessons between two groups of students which were respectively taught in their L1 and in English. The researchers report that no significant difference in subject performance between the two groups could have been made out, a result which supports the view that the use of a foreign language has no detrimental effect on subject learning. A comparable study by Badertscher &

Bieri (2009: 105f), probing the learning outcomes of around 200 Swiss pupils in the subjects Geography, History and Biology, has produced similar results: There were neither positive nor negative effects of bilingual teaching to be made out.

2.1.3 Intercultural competence

Another possible, although not proven, advantage that CLIL instruction is said to have by some experts (compare Bonnet 2004: 41) is its potential to raise intercultural competence and awareness in the learners. Intercultural competence is, as the name suggests, a person's ability to handle intercultural encounters and communicate effectively across cultural boundaries. It encompasses, as defined for instance by Kaikkonen (2001: 67), a number of skills and behavioural dimensions, among them rather general qualities such as the ability to show respect to people of different cultural backgrounds and to respond to them in non-evaluative and non-judgemental ways and also more specific ones like being aware of one's role in group encounters and behaving accordingly or the ability to manage interaction on the verbal and nonverbal level efficiently. Another sub-competence mentioned by Kaikkonen which seems especially relevant for CLIL contexts is a certain "orientation to knowledge, especially to the terms people use to explain themselves and their world" (2001: 67). The question remains, however, if Austrian and Anglophone scientific cultures are dissimilar enough as for the students to experience foreignness beyond the mere use of a foreign language.

On the other hand, foreign language teaching is, in itself, already a form of teaching intercultural competence. Kaikkonen (2001: 64) believes that the knowledge about our mother tongue already acts as a kind of constraint on our perception of foreign languages and cultures. Quite prominent examples for such a perception are idioms and fixed phrases which carry highly specific meaning and can not or only inaccurately be translated into other languages and often only make sense against a particular cultural background. As a result, language teaching is always also a form of teaching -more or less explicitly- intercultural competences. CLIL, as a form of language teaching, then necessarily also serves this purpose almost automatically. Still, this is then also true for any form of language instruction and hence enjoys no special status for CLIL contexts. In other words, if it is only the language which is experienced as foreign by the pupils, but not the way in which the world is analysed and interpreted (as would definitely be the case when comparing indigenous science to

Western science, for instance), it is only the language aspect of CLIL instruction that serves the purpose of raising intercultural awareness and competence.

2.1.4 Conclusions

From the results of current and past research, one can safely assume that CLIL instruction holds significant benefits for second language acquisition and language instruction in schools. Potential benefits for subject instruction, on the other hand, are manifold but remain speculative. Still, even though no such advantages of CLIL instruction have been proven so far, studies have shown that there seems to be no detrimental effect for subject learning, falsifying the common belief that CLIL instruction aids second language acquisition at the expense of subject learning. Finally, that CLIL has potential to raise intercultural awareness and competence is a reasonable, yet unsupported possibility which should not be discounted. Consequently, CLIL is a method of instruction which definitely has significant benefits and tremendous potential for learners and teachers alike.

2.2 CLIL practice in Europe

Though it is difficult to pinpoint the first attempts on CLIL teaching in the history of language teaching in Europe, many scholars report that European CLIL programmes have been around since the early seventies. Grabe & Stoller (1997: 5), for example, state that the first bilingual courses were taught in 1972 and add that they have grown much more popular ever since. Finkbeiner & Fehling (2002: 11) agree on the growing popularity, but claim that the first courses in Germany, although in French rather than English, were held even earlier, namely in 1969.

At present, as for instance Otten & Wildhage (2007: 12) point out, CLIL classes are being taught in over 40 countries of Europe, on all levels from kindergarten to university. This claim is also backed by recent data stating that, in the great majority of European countries, CLIL instruction of some sort is offered in at least some parts of mainstream education or in various pilot projects (EACEA Eurydice 2008: 40f). To be precise, there were actually only six European countries not offering any kind of CLIL instruction in mainstream education as of 2006/07.

Despite this quite long history and tradition, the rapid growth and wide spread of European CLIL programmes, there are, according to Finkbeiner & Fehling (2002: 6), still no officially recognised teaching models which teachers can resort to. Instead, so they argue, teachers have no choice but to deduce their teaching models from experiences with "best

practice". In like manner, there are only normative guidelines, but no common standard on which schools wishing to implement CLIL into their educational programmes can orient themselves, let alone official requirements that have to be met.

Still, there are a number of parallels and similarities which lead some scholars to distinguish different models and practices. Finkbeiner & Fehling (2002: 9), for example, differentiate between models where the subject in question is taught in a foreign language parallel to the regular teaching of the subject in the student's L1 to such models where the subject is taught exclusively in a foreign language such as English or French. They group these models under the term "bilingual branches" (orig. "bilinguale Züge", my translation) because they usually run from the beginning of a period of instruction to its end, spanning several years, and oppose those to "bilingual courses" (orig. "bilinguale Kurse", my translation) which stretch out over only one or a small number of topics. Otten & Wildhage (2007: 14) support this view and make a similar distinction between flexible, isolated, short-term "bilingual modules" (orig. "bilinguale module", my translation) which only last for single lessons or teaching sequences and long-term "bilingual branches" (orig. "bilinguale Züge", "bilinguale Zweige", "bilinguale Bildungsgänge", my translation). A distinction on another level is suggested by Brinton et al. (2008: 14-19), who introduce the concepts of theme-based, sheltered and adjunct instruction, which are based on the composition of L1 and L2 speakers in the class and to what extent language courses are held parallel to subject courses.

Interestingly, most European countries offering CLIL education do not impose any formal requirements, neither for students nor for teachers. Only a few countries require the pupils to undergo tests of their language skills or subject competence in order to be admitted to CLIL classes or branches (EACEA Eurydice 2008: 44). In like manner, education authorities of only very few countries set certain standards of qualification for CLIL teaching. Consequently, in the majority of countries, the respective schools themselves decide what level of qualification is required for a teacher to participate in CLIL projects (EACEA Eurydice 2008: 13). This is also true for Austria, although individual schools may select prospective students for CLIL instruction autonomously according to a set of criteria they seem fit.

2.3 Negotiation of Meaning

The concept of Negotiation of Meaning (NoM), a communicative process of chief importance to meaning making in spoken interaction, is central to this thesis, therefore this section is aimed at providing a comprehensive description and discussion. To arrive at a thorough understanding of NoM, I will begin by discussing how meaning is created in spoken interaction. We will see how an early approach to information transfer between speakers fails to capture many aspects of actual interaction and how the concept of Negotiation of Meaning can be used to describe such processes much more adequately. After this has been established, the role NoM plays in teaching and learning as well as some more detailed features of the concept will be discussed.

2.3.1 Shaping meaning in communicative interaction

There are several theories on how information is transferred between interlocutors in spoken conversation. In 1948, for instance, Shannon and Weaver (cited in Dalton-Puffer 2007: 67) argued for a so-called information transfer model, which was based on the very basic belief that in (oral) communication information is somehow transferred from the speaker to the listener. This information needs, of course, first to be encoded into spoken language (i.e. sounds) so that it can be transferred to the listener who needs to decode (i.e. make sense of) those sounds in order to arrive at the initial piece of information. If this process goes unimpeded, i.e. there is no problem with acoustic comprehension or faulty en- or decoding, then it is assumed that the information encoded by the sender completely arrived at the receiver and the transfer was successful. In other words, the piece of information the listener received would be identical to the piece of information that the speaker intended to send. (compare Dalton-Puffer 2007: 67-68)

Studies on actual talk-in-interaction, however have shown that such a complete exchange of information as proposed by an information transfer model rarely ever occurs, as Dalton-Puffer (2007: 68) points out. Rather, interlocutors draw on a number of available resources at their disposal instead of relying solely on grammatical and semantical structures of the language. Most importantly, speakers, more or less unconsciously, take it for granted that their interlocutors share a certain knowledge of the world on which they rely on in the process of shaping joint meaning. In like manner, interlocutors might draw on resources of the physical world surrounding them. All of these aspects are incorporated in and influence the interaction, as the necessary effort to arrive at mutual understanding heavily depends on the resources which are available to the speakers, for example the extent to which their

knowledge of the language or their experience with the world overlap and to what extent both speakers are aware of their respective partner's knowledge and experience. In order to establish common ground, these factors need to be negotiated. Hedge (2008: 266), for example, points out that any problems with these locally available resources, such as mistakingly assumed shared knowledge or inaccurately formulated messages lead to a natural negotiation process the main purpose of which is to make the meaning of the conversation clear.

It must be concluded then that meaning is usually not something which is there from the start and can readily be transferred, as an information transfer model would suggest, from one interlocutor to the other (as long as there are no obstructions, such as "noise" in the channel) but instead is interactively and continuously re-created, reviewed and shaped by the speakers. This process of "establishing, expanding and repairing common ground" (Bonnet 2004: 99) has been labelled *Negotiation of Meaning*¹, and, depending on how broad one chooses to define it, subsumes a number of interactive processes, such as explanation, repetition, paraphrase, using synonyms or antonyms, working with sub- and superordinate concepts and direct correction to name but a few (compare Badertscher & Bieri 2009: 132).

Hedge gives two excellent examples of how obstructions in interaction immediately cause negotiation of meaning in order to arrive at mutual understanding:

- A You musn't (sic!) come except you bring the children.
B I'm sorry, shall I bring my children?
- A Meet me under the dandelion at four.
B Sorry, where?
A Under the dandelion.
B But where is that?
A Oh, it's what we call the sculpture behind the Students' Union.
B I see. At four, you said.
A Yes.
- (Hedge 2008: 266)

A slightly different context in which NoM might occur, which is briefly outlined by Badertscher & Bieri (2009: 129), are situations in which the meaning of terms or expressions

¹ For an overview on naming conventions used in this thesis, refer to section 2.3.7

might differ between different languages or cultures. While, for example, there might be a specific term for a certain concept or expression in a foreign language, the two terms might, while denoting the same concept, differ in their connotative or more specific meaning. This is not only true for expressions in different languages, but also for different cultural contexts: People from an African country might, for instance, interpret terms like *Politics* or *Fairness* quite differently than Western Europeans, to give an example from Badertscher & Bieri.

2.3.2 Characteristics

From what has been discussed so far, it has already become apparent that Negotiation of Meaning is an extremely wide concept, encompassing a variety of interactive and communicative processes and characteristics, some of which deserve further attention. First, if one wants to distinguish NoM from related concepts, the defining characteristics of NoM need to be outlined. This is done, for instance, by Badertscher & Bieri (2009: 130f), who assign NoM the following labels: (my translations)

- *Situational*, as they arise from situations of unexpected misunderstanding.
- *Intentional*, as teachers specifically try to locate and solve comprehension problems: Teachers can also be the initiators of a Negotiation, even if its not them who experience comprehension problems, but suspect them in the learners.
- *Intersubjective* and *interactional*, as both interlocutors are equally involved in the process of discovering and clearing problems of understanding
- *Meta-communicative*

Furthermore, individual instances of Negotiation can be analysed into different phases, a variety of which has already been suggested by various scholars. While Bange (1991), for instance, distinguishes only two phases, namely *noticing a problem* and *solving* it, Selting (1987) categorises four phases (*Exposition, Correction, Ratification, Reprise*) (Both cited in Badertscher & Bieri 2009: 133). While this analysis could doubtlessly be taken into even further detail, the two denominating elements of negotiative processes are the emergence of some sort of misunderstanding and the accompanying act of noticing or communicating it on the one hand, and the strategies then applied in order to clear out and eventually resolve the problem on the other. In teaching contexts, there might be an additional third element directly connected to the initial Negotiation, where the problem is taken up again, comprehension is checked and consolidated.

2.3.3 Role in teaching and learning

While Negotiation of Meaning is a typical phenomenon in natural conversation, it has been argued that it is of special interest to educational contexts: As one of its main functions is to bridge knowledge gaps between speakers in order for them to reach mutual understanding there must be a kind of learning (and teaching) process involved. In fact, Bonnet (2004: 101) argues that, especially in science education, teacher-guided Negotiation gives learners the opportunity to develop knowledge themselves. In such contexts, the teacher, instead of imposing superior knowledge on the students, rather takes on a moderating role by asking systematic questions in order to create a negotiative situation in which the students gradually develop, repair and re-construct their own ideas. The teacher achieves this by selecting questions which stimulate ideas, encourage following a concrete line of thought or challenge potentially problematic conceptions. In such a setting, Bonnet fittingly sees the "pupil as scientist" (2004: 101), as this type of instruction mirrors meaning making through discourse of the scientific community and transfers it to the science classroom.

This approach is highly analogous to Badertscher & Bieri's (2009: 131f) definition of Negotiation of Meaning, who identify the following processes, amongst others, as Negotiations relevant to their study:

- Offering analogous approximations (translation mine), and
- *Bridging*, a support technique where the teacher offers simple but precise expressions in order to help the students correctly formulate a concept, which is, according to them, a typical element of CLIL teaching.

The basis of these and many comparable methods of instruction is the -controversially discussed- question-based and teacher-centred interaction format of the triadic dialogue (or Initiation-Response-Feedback pattern) which will be discussed in more detail in a later section.

While definitely being of interest for regular science, and also language, teaching, Negotiation of Meaning deserves special attention especially in the context of CLIL, for a host of reasons. First, if there are differences in meaning between the same expression in different languages, then such differences need to be made clear or be negotiated in class.

In like manner, intercultural issues may arise in bilingual teaching contexts, as has briefly been mentioned. In that context, Bonnet sketches the role of NoM for intercultural learning and language instruction. According to him (2004: 99f), NoM is of chief importance to intercultural learning contexts, as especially in intercultural encounters the creating,

shaping and repairing of common ground is a key competence which students should develop if they are to become inter-culturally competent communicators, which is one of the often-stated aims of CLIL. Therefore, in culture teaching Negotiation can be used as an explicit teaching activity which could, for example, be realised through role plays mimicking intercultural encounters in order for students to learn and practice these skills. It is important to note that in addition to establishing common ground, the interlocutors' identity is also object of the Negotiation in such encounters, as Bonnet stresses, which expands NoM to also include aspects of identity formation in some cases.

Another reason for the importance of Negotiation of Meaning for CLIL teaching has been suggested and analysed by Badertscher & Bieri (2009: 108ff), who make it one focal point of a study on the difference between regular instruction and CLIL teaching. They argue that students and teachers engaging in NoM might be one of the reasons why there are, despite the obvious obstructions posed by the use of a second language, no significant differences in the pupils' subject-specific performance between science classes taught in L1 and those in an L2. (compare section 2.1.2) They believe that pupils and teachers use Negotiation of Meaning to detect and clear out misunderstandings caused by the use of the foreign language. If dealt with correctly by the teacher, so they argue, such problems can be resolved quickly and easily, fostering comprehension. Indeed, their results (2009: 179) show that NoM can be found significantly more frequently in CLIL classes than in regular science classes². They conclude that Negotiation of Meaning must play a pivotal role in describing and analysing the differences between regular instruction and CLIL.

It is even assumed, as Badertscher & Bieri (2009: 129) point out, that the use of an L2 might actually make the students less hesitant to request clarification, hence the higher frequency of NoMs. They ascribe that to the possibility that the complexity of one and the same concept might be more apparent to the learners when it is presented in an L2 rather than in their L1. This does not mean, however, that the problem with understanding results from lack of L2 competence but rather from the second language highlighting the complexity of the concept itself. If that is the case, then Negotiation of Meaning poses a significant benefit for content learning in CLIL contexts.

² On the average, they found more than double as much negotiations in their CLIL classes than in comparable regular science classes

However, one must bear in mind that, especially in teaching contexts, the role of authority and power relations must not be neglected. Badertscher & Bieri (2009: 127), summarising the works of Deen (1997), Hatch (1978), Pica (1988) and Pica (1994), point out that there is an asymmetry between students and teachers engaging in Negotiation on two levels: Teachers not only hold institutional authority in the school, but also enjoy a status as experts in both language and subject knowledge. This is, obviously, not true for natural communication outside institutional settings. At most, one speaker might hold some authority because they have greater language competence than their interlocutors. Considering that it is important for students to feel as equal partners in classroom communication, one must conclude that the institutionalised setting might have a negative impact on the pedagogical value of Negotiation processes.

It has been said so far that NoM plays an important role in teaching and learning of the subject matter, regardless of the language of instruction, still, its role in language teaching is no less important and therefore of equal interest to CLIL contexts. Bonnet (2004: 98f), for instance deduces from a number of common language acquisition theories that language is also learnt through Negotiation. In practice, that means that purposeful Negotiation can, for instance, be used as a teaching method specifically aimed at discussing erroneous utterances produced by students. From this point of view, Negotiation seems to have very much in common with *corrective feedback*, a response by the teacher which explicitly or implicitly directs the learner's attention to a mistake he or she has just made (compare Lightbown & Spada 1999: 171f). Indeed, Dalton-Puffer concludes that

[r]epair and correction are [...] to be seen as expressions of the continuous process of negotiation of meaning which is going on during any verbal interaction. (2007: 91)

2.3.4 *Negotiation of Form*

However, one must, especially in language teaching contexts, be cautious not to confuse Negotiation of Meaning with a 'mere' *Negotiation of Form*, as Lyster (2002: 381f) advises. He convincingly argues that any form of corrective feedback which is aimed at highlighting and correcting language errors in students' utterances should actually not be considered an instance of Negotiation of Meaning, as Bonnet and Dalton- Puffer suggest. Moreover, in a

subsequent publication, Lyster (2007: 106-107) presents evidence from a number of other sources that Negotiation of Meaning is actually only concerned with the comprehensibility of the *meaning* of a message, and that grammatical accuracy plays, if at all, only a secondary role. In other words, if the teacher does not explicitly draw the learner's attention to language errors, they remain uncorrected as long as they do not obstruct understanding, and hence no language learning takes place. If, however language errors are pointed out and negotiated, its actually Negotiation of Form which is taking place. Nevertheless, the view taken up in this thesis (compare also section 3.4 and 2.3.7) is that this Negotiation of Form actually is a type of Negotiation (as its name suggests) which, as Bonnet is convinced, enables pupils to learn and develop their language skills as long as the teacher highlights such errors and provides opportunity for repair. From this point of view, it is in fact only the subject of the Negotiation which is different; in other words, it is not meaning which is jointly shaped and negotiated but knowledge about language. But, as both are integrated in CLIL, they are of interest to this study.

This, however, raises the question whether a trained science educator with no special training in the area of language teaching (a description fitting most teachers in Austrian CLIL situations) can be considered competent enough to offer adequate corrective feedback on a wide range of error types such as syntactical, lexical, or pronunciation errors that might occur.

2.3.5 A two-dimensional model of Negotiation of Meaning

So far, Negotiation of Meaning has been defined, briefly sketched and distinguished from related concepts. In addition, its communicative, interactive and educational backgrounds have been presented and discussed. In order to analyse NoM on a deeper level, I would like to outline Bonnet's (2004: 102-126) rather detailed in-depth concept of NoM in CLIL science teaching contexts.

According to his theory meaning emerges from acts (mostly, but not necessarily speech acts) and others' reactions to these acts, which generally mirrors the idea of the collaborative shaping of meaning which has been thoroughly discussed. He, however, distinguishes two perspectives from which Negotiation of Meaning can be analysed, *emergence* and *viability checking* (Bonnet 2004: 108,113; my translations).

Viability checking refers to the way interlocutors generate, bring in and question their own or other's suppositions and ideas on the basis of their own theories, experience and knowledge in order to create meaning which eventually gets accepted by every participant of

the interaction. In this context, viability refers to the consistency of a certain idea with reality: In real world experience, one can check the viability of their ideas against nature, that is, if an idea proves inconsistent with an observation, it has to be reshaped and adjusted, and learning takes place. In conversation, however, this process can manifest itself in form of Negotiation: Instead of checking one's ideas against real world observation, they are checked against the ideas and knowledge of the other participants. Here, too, learning can take place. Simply put, this dimension of NoM is concerned with the processes of the participants checking, comparing and adjusting their views and conceptions and eventually arriving at a common solution.

In what way meaning then actually emerges from such interactions belongs to the area of *emergence*. Bonnet (2004: 125) believes that the newly created meaning even exceeds the sum of all of the participants' contributions, and therefore constitutes meaning which is forged only through interaction. In other words, the emerging meaning has not been brought in in full by one of the participants but instead was constructed from all of the contributions and only then made explicit by a single speaker who summarises and verbalises the newly developed meaning. Again, when new meaning develops, learning can take place.

Viability checking and emergence make up one dimension of Negotiation of Meaning. Bonnet (2004: 103, 124f) also mentions a second one which is associated with the subject of the negotiation. He states that in educational contexts, Negotiation on the subject dimension usually works on two levels, *factual* and *social*. The factual level refers to the subject matter of the concept in question, in the case of physics education, this will most likely be physical concepts or phenomena. The, less perceivable, social level is concerned with the institutional and personal roles and hierarchy of and the social connections between the participants. Almost every Negotiation in educational contexts, as has briefly been mentioned in section 2.3.3, will feature elements of both, as teachers and pupils not only negotiate meaning of the concrete subject matter, but also negotiate their role and place in the institutional hierarchy.

2.3.6 Summary

Negotiation of Meaning was defined as an interactive communicative process where interlocutors try to overcome obstructions in order to arrive at mutual understanding. The nature of these obstructions can range from simple channel problems, such as poor volume or unintelligible speech, to more complex issues such as lack of shared knowledge or language competence. Furthermore, it was said that meaning emerges as speakers cooperatively

construct common ground and that this process is potentially helpful in educational contexts where teachers, albeit in a less 'natural' manner, strive to bridge knowledge gaps between them and their learners.

Additionally, I have argued that NoM can prove particularly useful for language, science and intercultural teaching contexts, all of which are - at least in theory - integrated in CLIL and hence of chief importance to this study.

Finally, I briefly outlined Bonnet's two-dimensional model of Negotiation of Meaning. On the first dimension, Bonnet distinguishes between viability checking and emergence, relating to the way speakers bring in and evaluate ideas and to the way meaning eventually emerges from that discussion respectively. He stresses that the emerging meaning actually exceeds the sum of all the individual contributions. On the second dimension, he classifies two possible subjects of Negotiation processes, factual and social.

2.3.7 Terminology

Describing the interactive process of meaning making through means of negotiating on different levels requires the use of accurate terminology, especially because of the use of words from everyday language such as *negotiation*. To avoid confusion and for the sake of uniformity, the following terminology, including any capitalisation, is used consistently throughout the text of this thesis:

Negotiation of Meaning (NoM)	The communicative process described in 2.3 where speakers jointly shape meaning in order to arrive at mutual understanding. (Note: Plurals abbreviated as <i>NoMs</i>)
Negotiation of Form (NoF)	The communicative process described in 2.3.4 where one speaker tries to correct a linguistically erroneous utterance by the other speaker (e.g. grammar or pronunciation mistakes)
Negotiation	(capital N) A communicative process in which two speakers try to arrive at mutual understanding or linguistic or factual correctness. <i>Negotiation</i> is used as a superordinate term encompassing Negotiation of Meaning, Negotiation of Form and any other possible forms of interactive Negotiation which are not dealt with explicitly. Note: Any verbal use is never capitalised (e.g. <i>to negotiate</i> or <i>negotiating</i>)
negotiation	(n not capitalised) Negotiation in its everyday sense without any linguistic implications.

2.4 Triadic dialogue and classroom interaction

Considering the proposed positive impact on learning that controlled and moderated Negotiation is said to achieve, every effort should be made by teachers to incorporate such interactions into their teaching. This is especially true for CLIL contexts, for which NoM has been hypothesised to be important in helping students cope with the additional demands. An interactive structure which is likely to support such Negotiations in teacher-learner communication might be the so-called *Triadic Dialogue* which was first discovered and given its label by Sinclair & Coulthard (1975: 21) and is extensively discussed in Dalton-Puffer (2007: 72-92). Triadic Dialogue is characterised by a quite fixed communicative structure consisting of Initiation (I), Response (R) and Feedback (F) moves making up a typical IRF pattern that is only rarely broken up or modified.

There is, however considerable disagreement among scholars' opinions concerning the effectiveness of the IRF structure for meaning making. Bonnet (2004: 102), for instance, even claims that triadic dialogue as a teaching method actually hinders negotiative interaction as he believes it artificially constrains the students to only short and concise answers to teacher questions. This notion is shared by Seidel et al. (2002: 53) who believe that question-based teaching forms, which are typically realised through triadic dialogue leave very little room for students to develop their own ideas. They add that in this form of teaching, learning phases are intermingled with assessment phases which has an adverse effect on pupils' motivation and readiness to participate.

Dalton-Puffer (2007: 72) is aware of these issues and acknowledges the potential problems which may arise out of such a rather fixed communicative pattern like the IRF structure and even adds that triadic dialogue is highly artificial in nature and that the interaction is clearly owned by the teacher, supporting Bonnet's and Seidel's claims that it imposes limitations of various kinds on the students. She convincingly argues, however, that while triadic dialogue might indeed limit the students' conversational space, her data suggests that the learners' conceptual space, on the other hand is "actually frequently under-determined rather than being over-constrained" (2007: 91). Hence, she is convinced that, despite its obvious problems, triadic dialogue can indeed be a basis and pattern for developing shared meaning. (compare also Dalton-Puffer 2007: 75) Additional support for teacher controlled triadic dialogue comes from Hirner (2002: 34), who is also convinced of its importance for

developing meaning and even recommends paying special attention to and rewarding student participation.

There are numerous other reasons for this. The technique of scaffolding, for instance, is, as Dalton-Puffer (2007: 74f) explains, a method where the teacher constructs knowledge collaboratively with the learners in an attempt to gradually reach thorough understanding. The teacher achieves this by guiding the learners in a step-by-step manner through eliciting, reflecting on or challenging students' ideas and conceptions. In doing so, the primary communicative tools put to use naturally are questions and (corrective) feedback, both of which fit perfectly into the IRF structure. Without doubt, such a technique can prove especially effective in science teaching contexts where complex concepts need to be gradually worked out in order to arrive at a thorough understanding.

Dalton- Puffer also elaborates on another aspect of the IRF structure which might be of considerable potential for negotiating and developing meaning: She (2007: 76-86) convincingly argues that the feedback (F) move in triadic dialogue can be a very effective communicative teaching instrument the possible applications of which go well beyond simply acknowledging or correcting what has been said. For instance, in some situations, when a plain correction of a learner's utterance would not suffice, a skilled teacher can use the F-move to re-contextualise, expand or reformulate the erroneous statement. In fact, a study by Lyster & Ranta (1997: 56) shows that simple recasts (=teacher reformulating student utterance minus the error) actually lead to learner uptake considerably less frequently than other forms of feedback³. In this light, it becomes even clearer that the whole class can benefit greatly from the skilful, varied and purposeful use of feedback. Lyster, in a later work (2007: 95), even goes as far as to claim that especially science CLIL classes can benefit greatly from this kind of "editing" (as he fittingly calls it) of classroom discourse, as an experienced teacher can use recasts in order to develop and maintain academic discourse. Additionally, a teacher might use the F-move to simply amplify an utterance which initially was unintelligible to the whole class because of poor volume or unclear speech.

³ In their study, only 18% of all recasts lead to the learner repairing their utterance, while other forms of feedback lead to repair much more frequently: Elicitation 46%, Clarification request 27%, Metalinguistic feedback 45%, Explicit correction 36%, Repetition 31% (Lyster & Ranta 1997: 55)

2.5 Guidelines and recommendations for successful CLIL practice

The nature of CLIL as an institutionalised form of instruction where a subject other than language is taught through the learners' L2 means that considerations from a number of scholarly fields, such as language acquisition theories, discourse analysis, general pedagogy or subject-specific didactics are of equal importance to its study. Hence, in developing guidelines or recommendations for effective CLIL practice all of these considerations must be taken into account. Fortunately, over the last decades, a substantial amount of literature on CLIL instruction and related concepts has been built up, and models and recommendations for teaching have been designed. Most of these guidelines are normative, deduced from experiences with practice or hypothetical statements deduced from literature or related fields. Only few are based on empirical research. In this section, I will draw on a number of these resources and summarise those points which I consider most important for enabling teachers to exploit CLIL to its full potential.

2.5.1 Language issues

Despite varying views on the matter (compare section 2.5.5) research suggests that there are several language and language-learning-related aspects that one cannot ignore if CLIL is to be successful. The literature reviewed suggests that there are two dimensions of language teaching and learning which are of concern: First of all, considering the, for students sometimes overwhelming, complexity of scientific concepts, every effort must be made to provide comprehensible input for the learners so that the use of the foreign language does pose no or only a minor additional challenge. This can be achieved through a number of support strategies which will be discussed in detail below. Secondly, many scholars suggest that there should also be phases of explicit language teaching in CLIL classes where either relevant or required language is taught directly.

2.5.1.1 Support strategies

As has been said, it is obvious that students might frequently be over-challenged by the language demands which teaching of complex conceptions through a foreign language poses. It must therefore be of chief concern for the CLIL teacher to cater for a wide range of support strategies in order to minimise language-related comprehension problems. In fact, almost all experts on the subject are aware of that issue and recommend a wealth of effective support strategies which are easy to integrate in most teaching situations.

Hirner (2002: 33), for example lists a number of, albeit rather self-evident, methods such as the reduction of talk speed, use of language appropriate to the learners' competence level, purposeful use of pauses and intonation, and use of gesture and visual aids. Additionally, most learners will benefit from some amount of redundancy, for example by repeating and/or paraphrasing key information as this aids general understanding. Despite their apparentness, teachers need to be consciously aware of these considerations at all times.

While this tailoring of teacher language to the requirements and proficiency of the students is without doubt the basis for providing comprehensible input in CLIL classes, it still needs to be consolidated with a mix of various other strategies in order to minimise learner comprehension problems. Krechel (2007: 201-202), for instance, suggests the use of brainstorming or clustering activities when new topics are introduced in order to activate related knowledge. For other contexts, he recommends the use of bilingual vocab lists or other printed resources containing lexical information that learners can resort to if needed. Such reference material is especially important whenever a written product of some sort, such as a lab report or a portfolio, is expected from the learners in the target language. In fact, Krechel generally suggests that learners should be provided with reference material containing listings of idiomatic expressions and conversational gambits⁴ for a variety of relevant situations common to science classes, such as participating in discussions, describing observations or asking for repetition or clarification.

Another, highly important, strategy for ensuring that learners receive comprehensible input is the functional use of the students' L1. While it might be common -and sound- practice in second language teaching contexts to use the target language exclusively, and hence treat resorting to L1 (*code-switching*) as unacceptable, it is important to stress that this should not be the case in CLIL contexts, as many experts are convinced. In fact, Otten & Wildhage (2007: 32), Thürmann (2003: 10) and Hirner (2002: 31) all treat code-switching as an effective way of providing help with comprehension problems and avoiding communication breakdowns. Moreover, Otten & Wildhage actually recommend using L1 materials, for instance a textbook, alongside to any other teaching materials in the target language, and to use this material in order to arrive at a mixed usage of both languages, for instance by requiring students to read in their native language and then discuss the matter in the target

⁴ conversational gambits are pre-fabricated phrases which are commonly used and have a distinct communicative function. (compare for instance Hedge 2008: 55)

language, or vice versa. The same view is also taken up by Krechel, who expressly objects to the idea of "dogmatic monolingualism" (2007: 200, translation mine) and additionally stresses the importance of ensuring that learners are familiar with relevant terminology not only in the target language, but also - or even especially - in their L1.

2.5.1.2 Explicit language teaching

Although language should primarily be taught in language lessons, there are still a number of contexts in which CLIL classes either provide opportunity for or even require some amount of explicit language teaching. The very basic language tools for participating effectively in classroom interaction and instruction have to be provided by the regular second language classes, as Thürmann (2003: 6) emphasises, the rather specific requirements of effective CLIL teaching still remain to be catered for, however.

Otten & Wildhage (2007: 28-30), for instance, point out that pupils above all will still be lacking the necessary subject-specific discourse competence (knowledge about the language which enables you to participate actively in written or spoken interaction) to engage in class discussions or deal with authentic scientific texts. Hence, they need explicit help and guidance to develop such competences like advanced reading comprehension skills and genre-specific writing skills. In fact, Otten & Wildhage are even convinced that any language training in CLIL classes should be exclusively discourse-oriented, even (or especially) lexicogrammatical practice (2007: 27), which is in uniform with current models of grammar instruction in communicative language teaching approaches (compare for instance Hedge 2008: 154f). The significance of such discourse-oriented language practice is also dealt with by Krechel (2007: 201) who stresses the importance of systematically training working techniques and skills relevant to the subject, similar to those mentioned by Otten & Wildhage. For achieving this, he recommends providing the students with reference material containing expressions and terminology (a similar suggestion has been made for improving comprehensibility), templates for certain text types or any kind of suitable authentic material.

The value of such authentic materials for the training of genre-specific discourse skills was also the subject of an earlier small-scale study by myself. It was found that instructional texts for learners are not only a rich source of genre-typical language items like collocations or fixed phrases but also that there are three main discourse moves characteristic to science instruction which are marked by very specific lexical and grammatical items that teachers and students should be aware of. To give two examples, it was found that cause-effect relations

are very often described with the use of the *Conditional I*, and that the genre is generally dominated by the use of the *Present Tense*. Directing the learners' attention towards these items and their function in the scientific context might be an effective way of improving discourse skills and teach grammar at the same time. (compare Schrönkhammer 2009: 6-11)

While discourse practice will improve the learners' ability to engage with authentic materials and participate in discussions more easily, it will most likely also have a significant impact on their production skills, which is, according to various experts, another desirable teaching aim for CLIL instruction. Thürmann (2003: 7-8), for instance, points out that the focus of CLIL classes is necessarily on input and that hence explicit practice on output skills needs to be provided additionally. Apart from work with authentic materials, and clues at genre conventions and formal requirements, as Otten & Wildhage 2007: 36-37 recommend, students also need opportunity for output, both spoken and written, and helpful feedback on the output they produce, Lyster & Ranta (1997: 41) demand. A particular challenge for students in this context is brought up by Otten & Wildhage (2007: 23) who note that, especially in CLIL contexts learner production might be impaired by considerable discrepancy between what they want to say and what their language proficiency enables them to say. Thürmann (2003: 10) is also aware of that problem and suggests using prompting and bridging methods in order to bridge these gaps. As a result, so he claims, students will be able to produce more than they would normally produce.

It has been made clear so far that the focus of any language practice in a CLIL context should be on developing and refining functional competences. This is, according to Otten & Wildhage (2007: 28-30) especially true for lexical work, as they are convinced that pupils need far more than 'mere' vocabulary lists. Instead, Otten & Wildhage (2007: 39-40) call for vocabulary to be presented in relevant context and as semantic fields, that collocations and idiomatic expressions⁵ receive special attention and that newly acquired terminology is consolidated through practical applications such as the labelling of diagrams and sketches or information transfer exercises. Furthermore, they emphasise that students should be made aware of the efficiency and accuracy of certain technical terms as opposed to the vagueness of more common terms. After all, the primary goal of CLIL language training, as proposed by Thürmann (2003: 11-12) should lie in enabling the learners to express thoughts, ideas and

⁵ semantic field - words and expressions that all share or are related to a common meaning.
collocation - two or more words which commonly occur together in natural English
idiomatic - naturally sounding language

conceptions accurately in the target language, not to make them memorise a great number of technical terms and vocabulary by heart.

2.5.2 Intercultural competence

As mentioned earlier, opportunity for training intercultural competence is one the proclaimed benefits of CLIL instruction. Obviously, in order to seize this opportunity, and reap its educational benefits, the teacher needs to take several points into consideration. In fact, Otten & Wildhage (2007: 35) even list "intercultural learning" as one of five areas of planning in CLIL teaching.

They (2007: 36) go on to argue that class activities and materials should be designed to make multiple cultural perspectives apparent to the learners, a demand which is also made by Krechel (2007: 13) who provides a more detailed account on the matter: He proposes that, by drawing on a number of resources, such as authentic materials or, if possible, even native speakers, cultural contrasts should be highlighted and discussed. Such differences could, for instance, be subject-specific academic conventions or working methods. Knierim et al. (2004: 39) also stress the importance of making such contrasts apparent, as, so they are convinced, many cultural conventions and views are part of the subconscious and therefore differences only become explicit in direct comparison.

This is also in uniform with Kaikkonen who states that because culture "distinguishes between the familiar and the foreign" (2001: 65), the main goal of teaching intercultural competence is "developing a healthy curiosity towards diversity" (2001: 73), which should be achieved by providing "opportunities for personal experience of diversity and foreignness" (2001: 73).

Intercultural aspects should play a decisive role especially in a setting where CLIL is confined to isolated modules (compare section 2.2), Krechel (2007: 199) adds. In such an environment, he advises, topics should be chosen which make sense to be taught in a foreign language. A particular relation to anglophone culture or other intercultural considerations could be one of these factors influencing such a decision.

As has been said in section 2.1.3, it remains unclear whether Anglophone and Austrian scientific cultures are diverse enough as to allow for extensive intercultural learning. The substantive amount of literature and recommendations however seem to suggest that skilled teachers should be able to locate several such aspects, and highlight and discuss them in an instructional setting.

2.5.3 General criteria for good science teaching

The sometimes very abstract concepts of science often pose a challenge for many learners. Fortunately, a substantial amount of theory, partly even based on empirical data, has been built up on science teaching and guidelines and recommendations for good teaching practice have been and are being developed. Because CLIL Physics teaching is, at its core, science instruction, almost all of these guidelines should also be valid in a CLIL context. In fact, especially in CLIL classes, where students are faced with the additional challenges of a foreign language, the teaching methods and style should conform to these suggestions all the more.

First and foremost, as Seidel et al. (2002: 56) -amongst others- point out, good science teaching should seek to generate interest and to develop a wide range of skills and competences as opposed to merely enabling learners to reproduce factual knowledge, as more traditional forms of science instruction seem to favour. Another important factor which is commonly mentioned, for instance in Hirner (2002: 33), is that instruction should gradually be developed around interconnected models and that relevance and meaning of these models for the learner's lifeworld need to be made clear to them. In other words, the literature at present suggests a paradigm shift from memorising facts, formulae, and natural laws towards a skill-centred approach through which students can develop competences that they feel relevant to their lives.

A more detailed insight can be gained from Seidel & Prenzel (2004: 179), who, in summarising a number of studies and other research, report that there are five indicators for science teaching quality, these are:

- A wide range and variety of teaching activities, put to use in an effective and flexible way
- Instruction that is oriented on clear teaching aims which are made transparent to the learners
- The factoring in of individual needs and prerequisites in the planning of activities and any feedback provided
- Establishment of respectful error culture, especially with regard to common and particular preconceptions which should be treated explicitly in class
- A systematic and goal-oriented approach to experiments

While all of these factors are without doubt of chief importance to successful instruction, they only play a secondary role for this paper, which is focussed on communication and interaction. Hence, these issues will be treated rather marginally in the investigation.

2.5.4 Institutional background

It is suggested in various literature that implementing CLIL instruction in a school requires long-term planning and close collaboration between science and language teachers as well as administrators. Thürmann (2003: 14-15), for example, stresses the importance of such a "whole school approach" and calls attention to the difference between "learning a language" and "language to learn", both of which are connected to very different parts of institutional instruction, especially in the context of Austrian subject- based schools.

A promising approach is suggested by Hirner (2002: 29), who proposes that CLIL should be introduced gradually and over various subjects: First of all, relevant and necessary vocabulary should be taught and consolidated in language classes, while at the same time isolated lessons from subjects where a lot of the communication works through context, such as sports or handcraft, should be held in the target language. In doing so, students receive the necessary language skills and can get used to instruction in the target language while it stays embedded in familiar context. After this introductory period, which doubtlessly requires a great deal of co-operation between teachers, the first science lessons should eventually be held in the target language. Of course, as Hirner emphasises, the difficulty of both the subject matter and the language need to start at a very low level and be increased only gradually.

Naturally, these considerations are, albeit to a lesser degree, also relevant for institutions where CLIL is taught only in form of isolated modules. However, in such contexts, there are additional issues that need to be taken into account. Concerning the choice of topics for such modules, Krechel (2007: 214) advises to base that decision on various considerations, as opposed to merely teaching random topics in the foreign language. Suitable topics could for instance include ones of special cultural relevance or ones allowing cross-subject relations to language teaching of some sort to be established. Nevertheless, isolated modules are, according to Krechel (2007: 214) still easier to integrate and less time consuming. On the downside, such modules also run the risk of being perceived as less engaging or even less important by learners and teachers.

Introducing CLIL to a school requires close co-operation of language and science teachers as well as administrators. CLIL needs to be carefully planned, orchestrated on various levels above the individual subjects or teachers and strongly integrated into the school's profile. Otherwise, it runs the risk of being an end to itself and therefore of little value to the learners.

2.5.5 Language vs. content

There is considerable controversy amongst scholars regarding the roles and priorities of language teaching and learning on the one hand and content instruction on the other. This becomes quite obvious in Dalton-Puffer's (2007: 12) claim that CLIL programmes are either predominately language-driven or content-driven, and that language and content are connected to not only different parts of the curriculum but also to different persons, as in most cases it is not clear whether a science or a language teacher should be responsible for a school's CLIL programme. Lyster (2007: 6), for example is convinced that the undeniable benefits for language learning should be the primary motivation for introducing CLIL programmes, otherwise, so he argues, the extra effort for students and teachers would not be justifiable, as it would be much easier for them to engage with the school curriculum exclusively through their first language. Thürmann, however firmly believes that the opposite is the case:

He who subordinates subject teaching to the sole aim of language learning and impairs the independency of the subject itself will, under the given institutional conditions, jeopardise the development and growth of CLIL teaching as a whole (2003: 5f, translation mine)

Thürmann's claim is supported by Otten & Wildhage (2007: 24) who argue that CLIL is no mere variety, but a practical application of foreign language teaching, and that, consequently, any explicit language instruction in CLIL classes can only be legitimate if it directly supports the subject teaching process. Thürmann (2003: 6) even demands that it are the language classes, which should provide students with the necessary tools to participate and communicate effectively in content- based classes. For my thesis, I take up the view that for successful and effective CLIL teaching, on the one hand language teaching theories as well as subject specific didactics must of course be taken into consideration, but on the other hand the integration of language and content means that additional issues, which go well beyond considerations for good language or subject teaching, arise and also need addressing. This view is, in fact, backed by various scholars: Brinton et al. (2008: 182), for instance, are

convinced that one can ignore neither language nor content if CLIL should be successful, and Dalton-Puffer (2007: 11) claims that, on the cognitive level, language cannot be separated from content at all.

2.5.6 Summary

As seen in this section, it is possible to identify a great number of factors which are able to influence the success of CLIL programs, branches or modules in schools decisively. I identified four major categories to subsume these factors which I see as the basis for successful CLIL instruction. Table 2.5.1 provides an overview on these categories and factors.

Support strategies	• visual aids • simple expression, repetition, paraphrase • code-switching • supportive materials (lexical lists etc.)
Explicit language teaching	• focus on functional competences • genre-specific discourse competence & language • opportunities for practicing & receiving feedback on output • semantic fields, focus on collocation & idiomatic expressions
Institutional entrenchment	• "whole school approach" • co-operation between language & science teachers & administrators • thorough planning
Improving intercultural competence	• lessons& activities aimed explicitly at highlighting cultural contrasts • authentic materials & native speakers

Table 2.5.1: Overview on recommendations for successful CLIL practice

3 Study design

3.1 Research aims

The general aim of this study is to analyse communication and interaction in actual CLIL classes against the background of the literature sketched in the previous section. In addition, it will be analysed to what extent the guidelines and recommendations for CLIL teaching suggested or demanded by expert literature are realised in actual classroom practice. The use of video recording and computer assisted close analysis of the material enables the discovery of a wide range of correlations and links between various elements of the lessons, the most interesting of which will be highlighted and discussed in the following sections.

3.1.1 Negotiation of Meaning

One focus of this study is the analysis of Negotiation of Meaning in CLIL classroom interaction. Based on the assumption that NoM can play a pivotal role in teaching and learning (compare section 2.3.3) and help to compensate for the additional challenge that the use of a foreign language poses, it will be tried to discover interaction formats and teaching contexts which seem to facilitate Negotiation between students and teachers. Additionally, possible connections between various contextual factors of the teaching situations and the occurrence, content and results of NoMs will be investigated and discussed.

3.1.2 IRF patterns and classroom interaction

As described in section 2.4, question-based teaching forms, usually realised through IRF patterns, have received much praise and criticism from various sides. In an attempt to contribute to this discussion, one focus of this study will be to examine these controversial claims by closely investigating lesson phases where such an interaction format is used, and its effects on classroom interaction.

3.1.3 Recommendations for practice

There is a great number of guidelines and recommendations for CLIL teaching, the most important of which have been presented in section 2.5. One of the central aims of this study is to examine how teachers put these suggestions into practice and what success they manage to achieve in doing so.

3.2 Method

At the very centre of this study are video recordings of actual CLIL classes. These recordings have been analysed on various levels using different methodology. In order to get

an insight into the socio- economical background of the learners and various other context factors such as the role of CLIL in the respective schools, interviews with the teachers were carried out additionally.

3.2.1 *Low & medium inference coding*

In order to receive a comprehensive data set on the basis of which classroom interaction can be studied, correlations discovered and implications drawn, seven variables for acquiring information on teaching and lesson contexts, communicative interaction between students and teachers, and NoM were designed. For every ten seconds of recorded lesson time, each variable can take one out of a number of disjoint values, depending on the teaching context or communicative interaction going on at that particular time in the classroom. This type of analysis has been labelled *time sampling*, as opposed to *event sampling*, which uses variable intervals depending on the duration of particular events in the video. (compare Seidel et al. 2003: 80) The variables and their according values were chosen on the basis of the literature reviewed and with respect to the proposed study aims. Some of the variables are based on the ones used in "Lehr-Lern-Prozesse im Physikunterricht" (Learning and Teaching Processes in Physics Education, translation mine), a study, which was carried out by the Leibniz Institute for Science and Mathematics Education (IPN) in 2000 and also utilised the method of time-sampled coding (compare Seidel 2003). All variables are described in more detail below.

While some of the variables, such as *language used by teacher*, are rather straightforward to decide and there is little chance of misinterpretation, others require some amount of interpretation and are hence influenced by the researcher to a certain amount. The former type is referred to as a variable with *low inference*, the latter as one with *medium inference*.

Nevertheless, as it is important for the validity of the produced data to ensure that coding remains consistent even in situations where there might be some uncertainty, a coding manual was designed, containing explicit guidelines and instructions on how such situations are to be treated. Great effort was made to anticipate possible ambiguous situations and to develop guidelines for dealing with them. The coding manual also offers a detailed description on each of the variables and can be found below.

The coding itself was carried out using *Videograph* (Rimmele 2005), a computer software offering extensive functionality required for carrying out such analyses.

Subsequently, computer software capable of statistical analysis was used to investigate correlations of interest between certain variables

3.2.2 High inference analysis

While low and medium inference coding generates a wealth of data from which a great number of implications can be drawn, many of the outlined aims of this study require a certain amount of sound interpretation and theory-based analysis. Therefore, for most of the research questions, the data gained through low and medium inference coding provides a solid basis of statistical data which serves as a starting point for further investigation and discussion. Such an analysis is then either aimed at capturing general impressions or characteristics of lessons, classes or teaching situations or at thoroughly analysing a certain situation, speech act or communicative event, and therefore going far beyond simply noting its occurrence.

This is especially true for investigating how many of the outlined features of good CLIL practice are realised in the classroom, but also for analysing Negotiations and IRF speech acts, as this cannot be done solely by comparing numbers. While those events are first captured during the coding process, events of special interest are subsequently sketched, described, investigated and discussed separately and to some detail, based on the theory reviewed. If necessary, passages of interest are transcribed. Such an analysis is, of course, subject to some interpretation by the researcher.

3.2.3 Teacher interviews

In order to answer questions about institutional background, student motivation and performance, and other context factors of particular interests, interviews were carried out with the involved teachers. A guideline outlining the most important questions along with a number of sub-questions was developed and used during the interview and can be found below. All interviews were recorded, the most important points summarised in the results section.

- Please tell me about your school.
 - What kind of social background do the students have?
 - Are there entry tests or requirements for students?
- How is CLIL integrated into your school's profile? What status does it have in the school?
 - What teachers participate in CLIL in your school? What (additional) qualifications do they have?
 - Do the teachers teach CLIL voluntarily?
 - How is the age distribution among the CLIL teachers?
 - How are the students prepared for CLIL classes?
 - Is CLIL mandatory for all pupils?
 - Are there entry tests or the like for being admitted to CLIL instruction?
- How would you judge the student's performance and motivation in CLIL classes?
 - Do you think students struggle with the use of a foreign language?
 - Have you gotten any feedback concerning that from pupils?
 - Do you think the students are motivated?
 - Are the students aware of any benefits of CLIL?
 - Do you know of any differences to the regular instruction?
- What can you tell me about the class(es) I taped? Concerning...
 - ...language background
 - ...socio- economic background
 - ...performance and readiness to do work
- Do you have any special motivation for teaching CLIL?
 - Do you experience difficulties in teaching in English?

Material 3.2.1: Interview guideline

3.3 Data overview

To ensure absolute anonymity of the participating teachers, students and schools, the five teachers will be referred to using capital letters A-E (e.g. "Teacher B"), the six classes observed using capital letters A-F (e.g. "Class C"), and the 14 lessons with a unique combination of a letter and a number, whereby the letter corresponds to the letters assigned to the respective class. (e.g. "Lesson E2" is the second lesson recorded in class E). In like manner, the three schools will be labelled using capital letters A-C.

Table 3.3.2 provides an overview on the participating classes along with their respective teachers, schools, average learner age and any additional remarks. The grades are counted, as is typical for Austrian grammar schools ("Gymnasium"), upwards from the beginning of secondary education, starting with the first grade where pupils are usually between nine and eleven years of age. Grades one through four are generally considered as "lower secondary education", while grades five to eight (ages 14-18) are considered "upper secondary education". Secondary education ends with the eight grade where students are required to take a number of written and oral school leaving examinations called "Matura". Students are usually around 18 years of age by then. For schools other than grammar schools, slightly different terms and definitions might apply, however, for this study, only grammar schools were analysed.

An overview on the topics, teachers and native speakers of the whole of the recorded lessons along with some additional information can be found in table 3.3.1 The column "Native speaker" states whether a native speaker teaching assistant participated in the lesson. (Note: As Teacher E is herself a native speaker of English, but not technically a native speaker assistant in the sense relevant to this study, her lessons are treated as if they were without the presence of a native speaker. To avoid confusion, "n/a" is stated in the respective column)

Detailed information on the schools and teachers is presented along with the teacher interviews and can be found in section 4.5.

Lesson code	Teacher	Topic	Comments	Native speaker
A1	A	The Lorentz force		Yes
A2	A	Applications of the Lorentz force		Yes
B1	D	Huygen's principle		No
B2	D	Huygen's principle - revision and application		No
B3	D	Diffraction		No
C1	B	Ohm's law, simple circuits	contains long group work phase with pupils measuring voltage and current in simple circuits	No
C2	B	Conductor value, non linear resistors	not coded because of technical difficulties with faulty timecode. (cf section 4.1)	No
C3	B	Ohm's law, simple circuits	contains long group work phase with pupils working on questions revising and expanding on what has been learned about Ohm's law	Yes
D1	C	Electrostatics - revision		No
D2	C	The electric circuit	Experiment: Pupils try to light up a bulb using wires and a battery	Yes
E1	E	Sankey diagrams		n/a
E2	E	Conservation of Energy		n/a
F1	E	Risk, risk assessment	The topic is an addition to the topic of <i>radiation</i> and possible dangers associated with it.	n/a
F2	E	Risk, risk assessment, interpreting graphs		n/a

Table 3.3.1: Overview on all recorded lessons and their topics

Class	Teacher	School	Grade	Age	Comments
A	A	A	7 th	16-17	
B	D	B	6 th	15-16	The class is using an English as well as a German textbook side by side.
C	B	A	6 th	15-16	
D	C	A	2 nd	11-12	
E	E	C	5 th	14-15	The multilingual setting of School C (compare 4.5.5) means that pupils of both classes are used to being confronted with and using a multitude of different languages daily. Many of them have neither German nor English as their mother tongue, but are very proficient in English.
F	E	C	7 th	16-17	

Table 3.3.2: Overview on participating classes, schools and teachers

3.4 Terminology and working definition

As has been discussed, Negotiation of Meaning is a rather broad concept subsuming a vast number of interactive events and processes. For this type of research, it is imperative to define beforehand which communicative processes are going to be treated as Negotiation of Meaning, as this greatly affects outcome and comparability with other studies. The definition used for this analysis is in parts based on the rather wide one used by Badertscher & Bieri (2009: 131f), although I will be using a much narrower and more restrictive definition. Additionally, as has been established, it is important to distinguish between Negotiation of Meaning and Negotiation of Form, a distinction which is reflected in the design of the respective coding variable.

For this study, Negotiation of Meaning is defined as a communicative or interactive process which arises situationally, i.e. unplanned, because of comprehension problems and is aimed at resolving such difficulties. Negotiations which arise due to obvious problems with (non-technical) vocabulary or unknown language structures as well as (mostly teacher-initiated) attempts at correcting language errors are treated as Negotiations of Form, conversely. Both are subsumed under the term *Negotiation*. (compare section 2.3.7)

The following events will be treated as Negotiation of Meaning, if they occur because of an apparent misunderstanding or upon learner request. If that event is based on one

described by Badertscher & Bieri (2009: 131f), their respective (German) term is stated in brackets.

- Discovering and working with misunderstandings ("Aufdeckung von Missverständnissen")
- Bridging and Scaffolding ("Sprachinseln")
- Offering synonyms or antonyms, repetitions or paraphrase ("Synonyme", "oppositionelle Begriffe auflisten", "Neuformulierung", "Wiederholung")
- Working with super- or subordinate concepts (mit Ober- und Unterbegriffen arbeiten)
- Illustrating with examples ("Veranschaulichung durch Beispiele")
- Explicit correction of imprecise or wrong statements ("Richtigstellung")
- Providing corresponding L1 terms of technical vocabulary.

Contrastively, the following events will be treated as Negotiation of Form:

- Correction of language errors ("Korrekturen auf sprachlich fehlerhafte Äußerungen der Lernenden")
- Bridging and scaffolding if aimed at correcting language errors or improving language use
- Providing the L1 translation of non-technical vocabulary ("Übersetzung angeben")

3.5 Coding manual & variable overview

This section describes the variables and their appropriate values. For the variables, the full label is given alongside a short tag in square brackets which was used during coding and analysis. For the values, the label is given alongside its respective number, which is what actually gets stored during the coding process for each interval. As already explained, for each ten second interval of the recorded lessons, exactly one value is set for each variable. Most variables contain an additional value titled *other* which is coded when either no clear choice can be made between values, the observed events do not fit any of the values, or the lesson is interrupted during that interval for some reason (e.g. in one lesson a sports teacher entered the class and talked to the pupils about a sports event she was organising for quite some time).

3.5.1 Medium- inference variables

Interaction Format

[IntForm]

The interaction format at that particular time. The interaction format mainly depends on who is talking and to what extent the pupils are expected to actively participate. In short, it describes how teachers and learners interact. In designing the coding guidelines for [IntForm]'s values, effort was made to capture the phase-like character of interaction formats, so that, for example, the teacher briefly interrupting an otherwise interactive phase to write on the blackboard would not be coded as *Dictation*. [IntForm] is based on the *Unterrichtliche Arbeitsform* variable of the IPN study. (Seidel 2003: 114)

1 Teacher lecture	Longer stretches of teacher talk, students are usually not supposed to come in unless for immediate problems or questions. Learners are expected to listen, maybe take notes or read along in their book or on worksheets. The teacher briefly interrupting for asking questions (brief, isolated IRF patterns) is still counted as lecture.
2 Dictation	Longer stretches of teacher talk, possibly (but not necessarily) accompanied by the teacher writing on the blackboard, or showing transparencies or other visual aids. Students are expected to copy either from the blackboard (or other visual aids) or write down what is being said. Students are not expected to come in unless for immediate questions or problems. The main distinguishing element to [1] is the students being expected to write, copy or draw.
3 Interactive	Question-based teaching or IRF pattern. Teacher(s) interact with the whole class, ask questions regularly, learners answer (either voluntarily or as selected by the teacher). Only shorter stretches of teacher monologue, which are directly related to either a following or preceding question. Students are supposed to participate actively, are encouraged to answer questions and come up with own ideas. Can also be limited to only one student interacting with the teacher (e.g. in a revision setting).

4 Silent work	Students are working individually and mostly silently after having received a task. Explanation of the task is coded separately, and is not part of [4]. Occasionally, students might ask questions.
5 Partner / group work	Like [4], but with the difference that the task is solved in pairs or small groups of pupils. Note: Interaction between individual group members is NOT recorded by any variable (such as [LangStud] or [Neg])
6 Student presentation	Longer stretches (at least three intervals) of student monologue, can also include more than one student (e.g. group presentations). Teacher is mostly silent or interrupts only for immediate questions or regulative interventions.
99 (other)	

Lesson phase

[Phase]

The current lesson phase. [Phase] mainly depends on what is being done in the lesson at that moment and how the discussed matter fits into a larger teaching context. As with interaction format, care was taken as to only code longer stretches of lesson time. [Phase] is based on the *Unterrichtsphase* variable of the IPN study. (Seidel 2003: 114)

1 Revision	Content which has already been introduced and discussed in previous lessons is revised either with help from the learners (or a single learner) or by the teacher alone (or any other means possible). No new content is introduced in these phases (apart from some details which might have not been mentioned so far). The learners are expected to have quite a clear idea of the matter.
2 New content	Content which is either generally new to the learners or which adds a new level of detail to a known concept is introduced, worked out or discussed. The learners are generally not expected to have some understanding about the subject.

3 Practice / Application	Phases, in which already established knowledge is put to practical use. Either through exercises requiring this knowledge (or skills) or through other activities aimed at discovering or presenting any form of practical implication or technical application of the concept in question. Also for phases in which already acquired skills are practised. Can also include teacher- centred activities, as long as no new content is presented, only implications discussed.
4 Summary	Content which has just been presented or worked out is summarised, paraphrased and the most important points repeated. Students are expected to know at least basic principles. Distinguished from [1] mainly in terms of thoroughness (in [1], details are mostly left out, [4] should pay attention to, maybe even highlight, details) and time passed since first introduction of the content. If the content is exclusively from previous lessons, or has already be summarised earlier, it should be coded as [1]. Still, summary might include, although not entirely consist of, some content from previous lessons if necessary.
5 Assessment	Any activity which explicitly counts towards the learners' final grade and include some form of clear performance feedback (including, but not necessarily limited to grades 1-5) Note: Revisions including only a single student and the teacher are only counted as <i>Assessment</i> if there is a clear performance feedback and they have some impact on student assessment. ⁶
99 (other)	

⁶ According to Austrian school law, active participation in class and performance outside of assessment situations must not be given a distinct grade, but needs to be taken into account for the student's final grade.

Topic category**[Topic]**

A rough categorisation of the current topic. This variable is included mainly in order to analyse the amount of lesson time spent on each of the different areas relevant for CLIL contexts. Some of the values are labelled "mainly", indicating that in CLIL contexts, language and content teaching are most of the time inseparable, nevertheless it can almost always be determined if the focus of a teaching activity is on content or language instruction.

1	mainly content work	Activities which are clearly, and explicitly content-oriented. The topic is clearly from the field of Physics or a directly related field. Language instruction occurs solely through the use of the target language. Isolated vocab hints are, provided they appear during this phase, still treated as [1].
2	mainly language work	Activities which are explicit language-learning activities with no or only rudimentary physics content. The language is the <u>subject</u> of instruction, not only it's medium. (e.g. various language clusters or lexical devices for describing graphs are presented, discussed and practiced, the graphs themselves being only of secondary importance to the activity)
3	content and language integrated	Genuine integrative teaching activities, i.e. activities which, through content instruction, manage to include a specific, well-defined language teaching aspect as well. (e.g. students' attention is explicitly directed to lexicogrammatical aspects of lab reports while being required to write such a report about an experiment they conducted in class)
4	intercultural aspects	Activities which are, at least partly, aimed at developing intercultural competence, raise awareness about culture-specific conventions or customs, or bridging cultural gaps of some sort.
5	regulative / organisational	No content or language teaching is taking place, organisational matters are dealt with or (detailed) instructions given.

6 off topic	A not necessarily related topic from the field of physics or any other field which has come up during the lesson is discussed. Also used for casual conversation of any sort, which is not related to the subject matter.
99 (other)	

Negotiation

[Neg]

This variable captures if Negotiation of Meaning between a teacher and a student is taking place in a particular interval, and if so, which type of Negotiation it presents. In other words, [Neg] is coded with a value other than [0] for intervals with Negotiation, the value depending on its type. As other variables, [Neg] does not capture Negotiations between students unless it is part of whole classroom interaction. (i.e. both students have the floor) Additionally, if the Negotiation takes longer to resolve and is not resolved interactively, but by, for example, lengthy explanations by the teacher, the non-interactive part of the Negotiation is coded as [Neg] = 0. Longer, interactive processes (e.g. scaffolding) are considered Negotiation, if they are directly related to a misunderstanding or clarification request, however.

0 None	No Negotiation is taking place in that interval.
1 mainly content related	Negotiation of Meaning. Occurred primarily because of a informational / conceptual mismatch with the subject matter discussed. Also includes problems dealing with technical terminology.
2 mainly language related	Negotiation of Form. Primarily concerned with erroneous use of collocations, discourse elements or structural problems or problems with non-technical vocabulary or expressions. Also includes problems with understanding because of unknown vocabulary. Mostly characterised in form of error correction initiated by teacher or clarification requests by a learner.
3 mainly channel related	Acoustic comprehension problems. Clarification requests because of poor acoustic comprehensibility (low speaking volume, distracting noises etc.)

9	not clearly distinguishable	Negotiation is taking place, it is hard to determine its exact cause, however.
---	-----------------------------	--

3.5.2 Low- inference variables

Language last used by teacher	[LTeach]
-------------------------------	----------

Records the language used by the active (i.e. the one that was speaking last) teacher. [LTeach] is always coded according to the very last utterance by the teacher, even if he or she is silent for longer stretches. The reason for this is to allow conclusions about how teacher language influences other aspects, such as, for instance, student language, also in the intervals following teacher utterances. Consequently, no inference can then be made about absolute teacher talk time.

1	English	
2	German	
9	(other)	only coded for intervals where there is no interaction or teaching taking place at all (e.g. teacher briefly leaves the class or talks to individual pupils about organisational matters while the rest of the class does not participate in any teaching activity). Such phases are of no interest to this study and are excluded from all analyses.

Language used by students	[LStud]
---------------------------	---------

Coded with a value other than [0] when one student is speaking to the teacher, native speaker or another student in an interactive setting (i.e. both students have the floor). In situations, where there are parallel interactions (e.g. in group work phases where one student is talking to the native speaker while another student is talking to the class teacher somewhere else in the classroom), only the one focussed on (i.e. which the camera and microphone captured primarily) is used for coding.

0	none	Students are silent / no interaction with a teacher or native speaker is taking place / student-student conversation with no particular group in focus is taking place
---	------	--

1	English	
2	German	
9	(other)	compare [LTeach]

Last active teacher

[Active]

This is only applicable for classes with a native speaker assistant and captures who of the two teachers interacted with the class last. This is not necessarily limited to spoken interaction, it can also include writing on the blackboard, for instance. In analogy to [LTeach], [Active] is also always coded even if both teachers are silent.

1	Class teacher	The class' subject teacher (i.e. the teacher who usually teaches the physics lessons in that class) interacted with the learners last. In classes without a native speaker assistant, [1] is coded for the whole of the lesson.
2	Native speaker assistant	The native speaker assisting the class teacher interacted with the students last.
9	not clearly distinguishable	Coded when it is either hard to distinguish who interacted last or when both teachers had about equal amount of talk time over the interval in question. If the latter is the case, and the following interval does not contain either teacher speaking, the following interval would be coded according to who interacted last in that particular interval.

3.6 Punctuation & code conventions

The following punctuation is used for transcripts of parts of the lessons.

3.6.1 *Interlocutors*

S#	Student along with number (#) to allow for distinctions when more than one student is talking in the respective transcript.
STs	More than one student talking simultaneously
CT	Class teacher
NS	Native speaker assistant

3.6.2 *Other code*

...	short pause
(...)	poorly understandable utterances
[...]	deliberate omission of single utterances / parts of utterances or several turns which are of no interest to the situation
(-)	non- lexical fillers such as "uhm"
(?)	(immediately following a word or utterance) poorly understandable, the most likely word is given
<u>xx</u>	underlined words or parts of words indicate emphasis
//	phonemic transcriptions
[S#]	substituted for student's names (e.g. teacher calls student by name), the number (#) matches the one assigned to the student in other parts of the transcript
--	simultaneous utterances
()	comments or translations are enclosed in round brackets

4 Results

4.1 Preliminary notes

Out of the 14 videotaped lessons, 13 have been coded (see below) according to the seven variables presented in the previous section. The coding produced a data set of 3498 coded ten-second intervals, each of which has been assigned exactly one value per variable. This equals a total of about 583 coded minutes, which in turn equals an average of almost 45 minutes per lesson⁷.

It is important to note that the time immediately before the beginning of a lesson (the moment where the teacher starts the lesson, not the ringing of the bell or the start of the recording), which is mostly characterised by students taking their places, chatting, talking to the teacher or getting ready for the lesson was not coded at all. The same is true for the time after the teacher officially closed the lesson. In other words, only intervals between the actual start of the lesson and its end were coded, not the whole recordings (which necessarily started a few moments earlier and kept running after the lesson had ended) As a result, the average of about 45 coded minutes per lesson is five minutes short of the official lesson in all of the schools of 50 minutes.

As mentioned above, only 13 of the 14 lessons have been coded, this is due to the fact that one recording produced a data file with a corrupted time index, rendering the file uncodeable, as the timecode of the recording could not be brought in sync with the timecode the coding software produced. Still, playback worked fine, so this particular lesson (C2) was still used for high inference analysis where applicable.

Another problem which occurred only later during the coding process was that an additional value for the [Phase] variable would have been required to capture phases where the results of group or individual work phases are compared and discussed. As the nature of this kind of analysis makes it quite complicated to add variables after coding has been started and the effort of doing so would have bore no relation to the additional information gained (only a few of these phases were found), such phases were coded as *other* as to avoid interference with other results.

If not mentioned otherwise, all numbers presented in this section are rounded to the first decimal.

⁷ All numbers rounded to full numbers

4.2 Negotiation of Meaning

4.2.1 Occurrences and distribution

First of all, Negotiation seems not to be a rare nor an isolated phenomenon, as 156 out of the 3498 coded intervals contained some form of negotiation, which makes up about 4,5 per cent of the total number of intervals. In addition, Negotiation appeared at least once in 12 out of the 13 lessons (compare table 4.2.1). Furthermore, phases containing Negotiation seem to be quite unequally distributed over the different lessons and especially the teachers (compare table 4.2.2), with percentages of these phases ranging from zero to over 15 per cent.

<i>Lesson</i>	<i>Negotiation</i>	<i>Percentage</i>
A1	42	16,2
A2	5	2,0
B1	8	2,9
B2	43	15,5
B3	3	1,0
C1	0	0,0
C3	10	3,6
D1	12	4,3
D2	6	2,2
E1	16	5,8
E2	3	1,2
F1	5	1,8
F2	3	1,0
<i>Total</i>	<i>156</i>	<i>4,5</i>

Table 4.2.1: Distribution of Negotiations over lessons as total intervals and percentage of total intervals per lesson

<i>Teacher</i>	<i>Negotiation</i>	<i>Percentage</i>
Teacher A	47	10
Teacher B	10	2,2
Teacher C	18	3,4
Teacher D	54	6,7
Teacher E	27	2,5

Table 4.2.2: Distribution of Negotiations over teachers as total intervals and percentage of total intervals per teacher

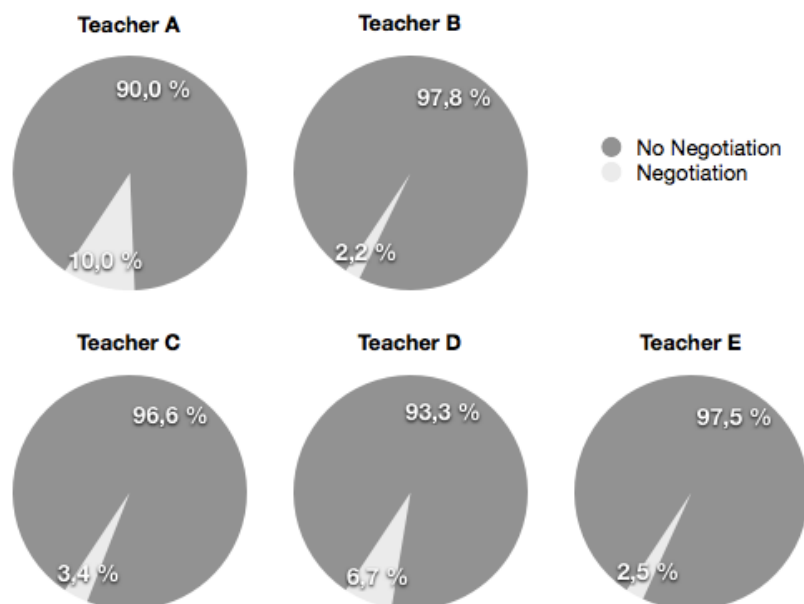


Diagram 4.2.2: Percentages of Negotiation to total number of coded intervals per teacher

Interestingly, the two lessons with the greatest amount of negotiation, B2 and A1, did not feature any special teaching methods or activities. Instead, the great majority of Negotiations in these two lessons are caused by confusion about rather complicated concepts and terminology. In lesson B2, for instance, the teacher explained the effect of *diffraction* using *Huygens' principle*. This caused some confusion, especially with the terms *elementary wave*, *wave front*, *wave crest* and *wavelet*, but also with the concept itself, as transcripts 4.2.1 and 4.2.2 show.

Transcript 4.2.1, from lesson B2

CT	(sketching boundary behaviour of wavefronts on the blackboard) What is this thing coming at the mirror(?) here?
S1	A wave
S2	--Light
S3	--wave
S2	--Lightwave
S4	(...)
CT	Wavelength?
S2	Wavefront?
S5	A wave <u>let</u> !
S6	length!
CT	Wavelength?
S6	Ja!
CT	(-) not yet.

Transcript 4.2.2, from lesson B2

-
- (a sketch illustrating diffraction at a boundary is discussed)
- S1 Also... das Ganze? ("So... the whole thing?")
- CT --ist der Lichtstrahl ("--is the ray of light")
- S1 --ist der Lichtstrahl und das? ("--is the ray of light and that?") (pointing at a spot on the sketch)
- CT Das ist eine Wellenfront vom Lichtstrahl ("That is one wave front of the ray of light")
- S1 Achso! ("I see!")
- CT --This is one wavefront of the
- S1 --und das andere ist schon, es gibt aber mehrere oder wie und das ist? ("and the other is already, but there are more than one?")
- CT Es gibt mehrere was? ("There are more of what?")
- S1 Nein. Ich, egal, ich war letztes mal nicht da ("No. Doesn't matter, I've not been here last time")
- CT --Wavefronts? Jaja! - you have wavefronts here, and here and here.
-

The same is true for lesson A2, where students had problems grasping concepts such as the right-hand-rule for determining the direction of the Lorentz force and the concept of field lines:

Transcript 4.2.3, from lesson A2

-
- S1 (discussing the right-hand-rule with another student) Dann ist es nicht wurscht ob ich so oder so mach! ("So then it's not the same if I do it this way or that way!") (alternating her hand, fingers rounded, thumb stretched out, between two different positions)
- [...]
- CT What's the problem? ...Hm? Right hand?
- S1 --muss ich so machen oder so? ("do have to do it this way or that way?") (again showing the two hand positions)
- CT It depends on the (-) direction of the (-) current.
- NS --It depends on where the positive (...)
- CT If we have (...) Let's make it this way (draws a straight line on the blackboard with a plus on one, and a minus on the other end) if we have plus here, and minus there, so, plus to minus, it's this direction, okay?
- S1 Ja, eben, und bei dem oberen is es ja so. ("Quite, and with the one above it's like this!") (showing the opposite hand position)
- [...]

- NS Exactly, so now on your hand, you're right, now it's rotating this way! (moving his hand in a circular motion next to the student's hand to indicate direction of the field lines)
- CT -- (...) in this direction! Okay?
- NS Okay, it rotates the way your fingers are pointing, so now my fingers are pointing down, so it goes (...) (indicating direction with his hand)
-

Concerning interaction formats, there are some clear trends which can be made out (compare table 4.2.3). First of all, Negotiations seem to be by far most common in interactive teaching forms, with 7,4% of all interactive phases containing some form of Negotiation. In fact, more than half of all Negotiations appeared in interactive teaching forms. Dictations, on the other hand, feature the least Negotiations, as only less than one per cent of all dictation intervals included Negotiation. Interestingly, it also seems to be very uncommon for group work phases to contain Negotiations, with Negotiations being only a little more frequent than during dictations. However, this is most likely due to the fact that only Negotiation between the teacher and the students has been recorded, and possible Negotiation between the group members themselves only when that particular group was in focus. Also, although one third of all student presentation phases contained Negotiation, the significance of this value remains questionable, as there were only a total 27 intervals coded as student presentations, and only two instances of (longer) student presentations found in the recorded lessons.

<i>Interaction Format</i>	<i>Intervals</i>	<i>%Total</i>	<i>%IntForm</i>
Lecture	24	15,4	3,2
Dictation	2	1,3	0,8
Interactive	92	59,0	7,4
Silent work	24	15,4	3,4
Group/ Partner work	4	2,6	1,1
Student presentation	9	5,8	33,3
other	1	0,6	0,7

Table 4.2.3: Distribution⁸ of Negotiations over interaction formats

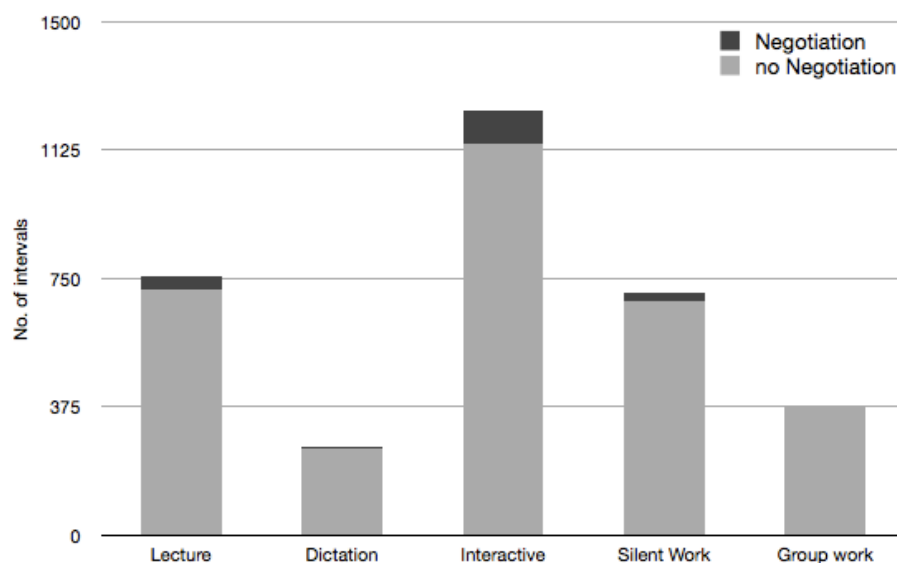


Diagram 4.2.3: Distribution of Negotiations over interaction formats

Of the four different lessons phases recorded, Negotiations are most common during revision and summary phases, with only a little less than nine per cent of each phase consisting of Negotiation. The least Negotiations can be found in phases where new content is presented. (compare table 4.2.4)

⁸ in tables 4.2.3 & 4.2.4 %Total refers to the ratio of intervals containing Negotiation in the respective phase, topic or format to the total number of intervals containing Negotiation expressed as a percentage.

%Phase, %Topic, %IntForm then gives the ratio of intervals containing Negotiation in the respective phase, format or topic to the total number of intervals for that particular phase, format or topic.

(i.e. while the %Total column gives the distribution of Negotiations over phases, topics and formats, the last column states which percentage of the respective phase, topic or format actually contained Negotiation.)

<i>Lesson phase</i>	<i>Intervals</i>	<i>%Total</i>	<i>%Phase</i>
Revision	45	28,8	6,6
New content	41	26,3	3,5
Practice/ application	59	37,8	5,3
Summary	8	5,1	7,4
other	3	1,8	0,7

Table 4.2.4: Distribution of Negotiations over lesson phases

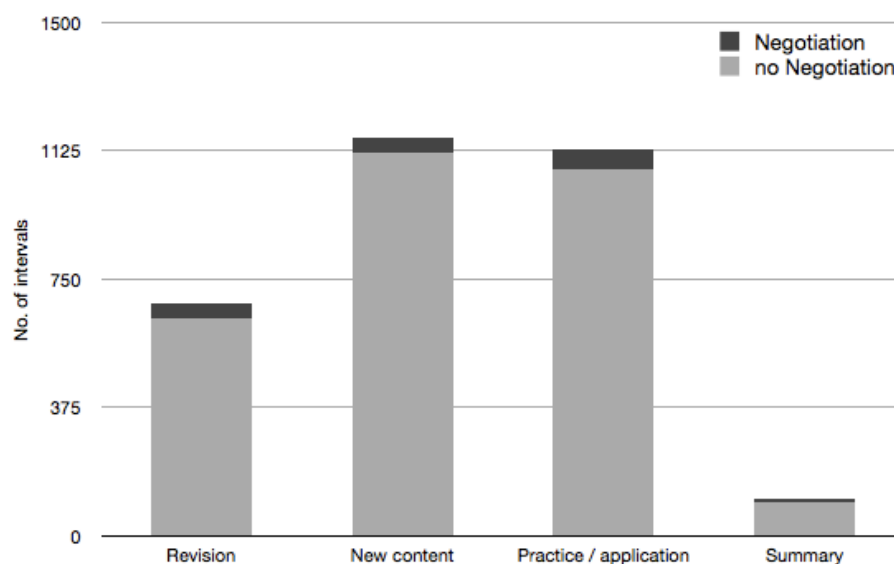


Diagram 4.2.4: Distributions of Negotiations over lesson phases

Considering that the vast majority of lesson time (85,8%) was centred around content work, it is not surprising that 95,9 per cent of all Negotiations recorded occurred also during these phases, as can be seen from table 4.2.5. There were only very few teaching activities with content and language integrated content and even less with pure language content, and merely one of them contained an instance of Negotiation.

<i>Topic</i>	<i>Intervals</i>	<i>%Total</i>	<i>%Topic</i>
Content work	148	94,9	5
Language work	0	0	0
Content and language int.	1	0,6	1,4
Intercultural work	0	0	0
Organisational	3	1,9	1
Off-topic	3	1,9	1
other	1	0,6	1,5

Table 4.2.5: Distribution of Negotiations over topics

4.2.2 Types and content

Strikingly, the great majority - almost 70 per cent - of all recorded Negotiations was mainly content related (Negotiations of Meaning), and only a little more than 20 per cent language related (Negotiations of Form), which might, considering the extensive use of the foreign language, be perceived as rather surprising. However, there were 18 recorded intervals in which no clear decision as to the nature of the Negotiation could be made, implying that there might have been at least some language- related misunderstanding or problem which partly caused the Negotiation process. Not less surprising is the fact that there were almost no Negotiations which were plainly due to acoustic comprehensibility.

<i>Negotiation type</i>	<i>Intervals</i>	<i>Percentage</i>
(mainly) content related	118	69,0
(mainly) language related	34	19,9
channel related	1	0,6
not clearly distinguishable	18	10,5

Table 4.2.6: Distribution of Negotiation types

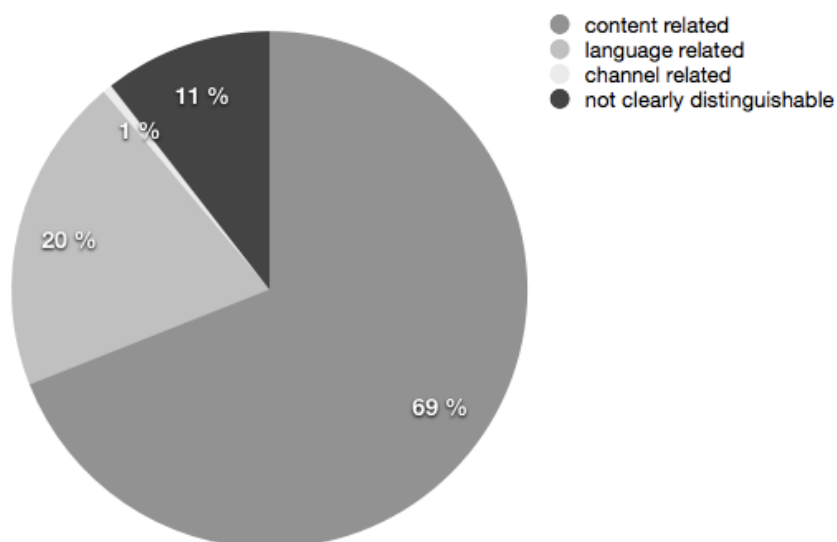


Diagram 4.2.6: Distribution of Negotiation types (rounded to full numbers)

Although most of the Negotiations were content related, other determining factors, such as causes, initiation (and initiator), length and resolving strategies were still quite diverse and provide an interesting basis for discussion.

A general impression which can be made in quite a number of situations is that in IRF phases, Negotiations seemed often to be teacher- initiated, mainly because of error correction purposes or in order to arrive at more accurate language, which was often realised through scaffolding or corrective feedback:

Transcript 4.2.4, from lesson D2

- S1 In batteries there are... Säuren (acids)
CT Oh, great! (-) yes, "acids"
NS -- Ah! Acids - in the battery!
S1 And they react (-) together and so... electric energy comes out.
CT Yeah, right! this is (...)
NS -- This is really good - can you use the same kind of sentence that we just used with the flashlight with the battery? (note: The class has been discussing how certain devices transform energy from one form to another explicitly using the words "energy" and "transform")
S1 (-)
NS So you have acids, right?, inside the battery there are acids, what kind of... wait, a word starting with "e"? When we were talking about the flashlight?
S2 E-card! (some laughter)
NS It converted *hmhmhm* to *hmhmhm*?
CT What can you convert?
(...)
CT Everything in the world is about converting...?
S1 Energy?
CT Energy!
NS --Yes! Energy! So, in the battery you have acids - what kind of energy is that?
S3 Chemical energy!
CT Great! You two should work together!
-

This passage was then followed by a few more, similar interactions with the teachers putting much effort into arriving at precise language. A similar situation can be found in another lesson, where the teacher tries to develop the term *centre of gravity* from rather imprecise expressions suggested by the students. This Negotiation had been preceded by an experiment where some students had to try and touch their toes while they were standing with their backs against the wall:

Transcript 4.2.5, from lesson E2

- S1 It doesn't work because the balance is, like, in the front, so you fall.
- CT Okay, the balance is in the front, okay, alright, have you got another word for this "the balance is in the front"? Another way of saying it?
- (...)
- S2 The mass of the body is more so (...)
- CT The mass of the body is towards the front! Come on, another word! A word in German - he's got one!
- S3 Schwerpunkt. (*centre of gravity*)
- CT Schwerpunkt. You know what that is in English?
- S4 (...)
- S5 middle point?
- CT This middle - "Schwerpunkt", "middle point" isn't such a (...)
- S6 Isn't it the "centre of gravity"?
- CT It's the centre of gravity. Because the centre of gravity isn't above their feet, (...) they fall over!
-

Another common cause for Negotiation to appear was the pupils not being able to express themselves accordingly in trying to describe a certain phenomenon or concept. This is especially true if the concept in question was a rather abstract one. In such cases, it was often not easy to distinguish whether the source of the problem is the student not knowing or understanding the concept thoroughly, lacking the language to express him- or herself accordingly or not being able to put his or her thoughts into words. In every case, some sort of Negotiation occurred, to often different results.

In the following case, the teacher was comparing and discussing results of a student experiment on electric circuits from a previous lesson with the students in an interactive setting:

Transcript 4.2.6, from lesson C3

- (A circuit diagram has been drawn on the blackboard)
- CT (drawing numbers into two points of the diagram) When we name some points with a number - here's point number one, here's point number two - is there a voltage across these points?
- (note: The two points are along the same line, without any resistor in between them, so the voltage would be zero across the two points)
- S1 (raises hand)
- CT [S1]?
- S1 No.
- CT Okay, why?
- S1 But(?) there is no... difference... between two... I don't know... it's... it's like... (moves hands up and down in opposite directions) there has to be a difference to (-) measure the voltage.
- CT Yeah, what difference?
- S1 (...)
- CT Okay...
- NS There is definitely the resistance.
- CT When we talked about voltage, we didn't already know what resistance means. Could we explain it in some other way?
- S1 (Raises hand again)
- CT [S1]?
- S1 In charge. ... Because, when... when you put it, for example, before the light bulb and afterwards, there is a difference in... charge?
- CT No.
- S1 In energy?
-

The discussion then went on for some time and was eventually resolved by the teacher pointing the student's attention towards the definition of voltage, which is energy per charge and explaining that there is no difference in Energy between the two points, hence the whole term equals zero.

Apart from the (quite common) misconception of charges being used up, the student seemed to have grasped the idea of a difference of some sort being required in order to measure a voltage. It remains unclear whether he didn't understand the concept thoroughly or whether he merely had problems expressing it. During the discussion he was eager to continue and to get his meaning across, which became clear especially towards the beginning

when he was the only one raising his hand. Additionally, his use of body language suggested rather failure to express his ideas than a lack of knowledge.

A comparable situation arose during a voluntary revision phase on Huygens' principle, which had been discussed in the previous lesson:

Transcript 4.2.7, from lesson B2

- S1 Every wave... crest (...) have (-) wavelets (-) or elementary sources as (...) and those (-) form the new wave crest.
- CT I wouldn't say "form the new wave crest" necessarily. It's true that it's a wave crest that makes this thing but I wouldn't say that it's a wave crest. What (-) what is, like, the term for it? (S2 raises hand) You don't know the term? - [S2]?
- S2 Wavefront.
- CT It's the wave front. That's what we're talking about. So, every wave front, on the wave front, every point...?
- S1 (-) is a wavelet.
- CT No, not the point is a wavelet, but you (-) it's a source of wavelets, and then the new wave front - okay, go on.
- S1 (-) ...kann ich's aufzeichnen? ("may I draw it?")
-

As the student subsequently managed to draw a rather good sketch of how elementary waves form new wavefronts, the source of the problem seems to be his having been unable to express his ideas in spoken interaction. In this case, both Negotiation as well as scaffolding by the teacher had only little effect, only by drawing did he eventually manage to get his ideas across. Whether the student would have faced the same problems using his L1 cannot be determined at this point any more.

This seemed to be a typical phenomenon during revision phases, a possible reason might be that the students have already developed some knowledge, but might not have arrived at a deep enough understanding of the concept to be able to express it in their own words, let alone explain it.

A quite different, yet still very frequent source of Negotiation was the pupils not understanding prompts, instructions, questions or explanations by the teacher. However, such misunderstandings seemed to only be Negotiated when comprehension was of great importance or required by the students to continue, as was the case when the pupils were engaged in direct conversation with the teacher and some sort of result was to be achieved.

In the following scenario, the students were working on a worksheet, answering questions on energy conversion in the context of *pole vaulting*, when one pupil came up with a question, initiating what can be considered a typical example of Negotiation of Form:

Transcript 4.2.8, from lesson F2

- S1 What does it mean "can you account for the position of (...)"
- STs --Yeah?
- CT Like- "can you give an explanation for (...)"
- (...)
- S2 Yeah - what do you mean "account" the position?
- CT "account for" - "explain" mainly.
- S2 Why it's placed there?
- CT Yeah.
-

The main problem obviously was that many of the students did not know the expression *to account for*, which kept them from completing the according question. In this case they had little choice but to demand an explanation, resulting in negotiating the expression's meaning.

A quite similar situation came up during a revision about *Lorentz force*, although in this case the student did not need help from the teacher but managed to grasp the meaning of the problematic expression himself, possibly from the context:

Transcript 4.2.9, from lesson A2

- CT What happens if you change the direction of the... of the current?
- S1 If you change the current (...)? ...What do you mean? ...
 Oh! You change the wires! (makes a gesture crossing his hands)
- CT (...)
- S1 The same thing when you change the magnet... magnets, wasn't it?
-

In the next case, the problem did not lie not in the understanding of a concept, but rather in misunderstanding the teacher's question about the meaning of one specific element in a formula that was being discussed.

Transcript 4.2.10, from lesson A2

- CT Which information do you get if you have (-) a value for B ?
(note: B being the magnetic field here) ... If it's, I don't
now, X Tesla?
- S1 ...Do you want a formula?
- CT No, no, no, just, just... what (-) does this value say?
- S2 How strong the magnetic fields are?
- CT Yeah, M-hm! It gives us information about the field.
-

Most likely, the question was formulated in a confusing manner so that the pupil was unable to decipher the meaning the teacher tried to convey, the subsequent Negotiation, however, was quite successful, enabling another student to correctly answer the initial question.

In other cases, Negotiation occurred out of mistakenly assumed shared knowledge. For example, when one class was discussing the relation between voltage and current for different consumers, the teacher mistakenly assuming that the concept of *proportionality* was clear enough to the students in order to answer the questions, which obviously was not the case:

Transcript 4.2.11, from lesson C2

- CT Are voltage and current not proportional in the case of the
other element?
- S1 --Yes, they... are not proportional.
- CT (-) look at the diagram!
- S1 (...)
- CT So, is there a line?
- S1 Yes.
- CT Okay, and what does it mean when you (-) see a line? Are
then this... the current and voltage proportional to each
other or not?
- S1 Okay, they are, yes.
- CT They are, okay, so that's the difference.
-

Here, it remains questionable if genuine understanding has been reached, as there were only two options for answering the initial question (current and voltage are proportional or not), and one of them had already been falsified.

A comparable situation can be found in lesson B2, where the teacher might have taken it for granted that the students knew basic principles of light emission and reflection and hence decided not to establish that background for the example he was giving. Although here, the misunderstanding would have most likely remained unresolved if the student hadn't initiated a Negotiation:

Transcript 4.2.12, from lesson B2

- CT (holding a mirror) Because light coming from me is reflected used (-) according to the law of reflection, so there is one angle at which the light leaves the mirror with my image.
- S1 --Maybe(?) we give off light?
- CT No, we don't! I reflect light from the sun.
-

Another quite common form of misunderstanding triggering Negotiation of some sort was the lack of shared language knowledge. In the majority of cases, such situations were dealt with by the teacher or native speaker providing the appropriate German expression, in some cases, however, this was either not possible or not done on purpose. In the following case, for instance, the student did not only not know the English word, but also could not recall the German one:

Transcript 4.2.13, from lesson D2

- (The class is brainstorming devices which convert electric energy)
- NS What about another one? - [S1]?
- S1 I don't know what is (-) What is called, es liegt mir aber auf der Zunge. ("it's on the tip of my tongue")
- NS A What? (-) Oh, "It's on the tip of my tongue!"
- (...)
- S2 Beschreib es, was es macht! ("Describe it, what it does!")
- S1 --Es, es macht Blitze. ("It makes lightning bolts.")
- NS Lightning?
- S1 Yes.
- S3 Teslaspule?
- NS A flash or (...)?
- S1 Eine Teslaspule!
- CT Ah, okay - A Tesla coil!
- NS A tesla coil!
-

Here, the problem was actually resolved by another pupil who seemingly knew that tesla coils are used to produce lightning bolts.

Another situation where resorting to German was not a possible solution obviously was when students were speaking directly to the native speaker, who usually did not use a single German word, because of which the pupils might have concluded that he does not speak German at all. In the following scenario, the learners were engaged in group work on electric circuits, with the class teacher and the native speaker moving around the class offering help where needed. In such a setup, the class teacher is normally not part of the interaction between the group and the native speaker, and also not as readily available as in interactive settings. and can hence not offer a translation:

Transcript 4.2.14, from lesson C3

- S1 [NS]?
NS Hm?
S1 What's "cross-sectional area"?
NS (-) It's when you
S2 (...)
NS Yeah, that's a good question, when you cut something; like, you have a wire, and you cut it, the cross-sectional area is the area, like, inside the wire.
S3 Like *thickness*?
NS It's like thickness!
-

In this case the meaning of the expression *cross-sectional area* was negotiated between the native speaker and actually two pupils to whom it was unclear. The Negotiation was resolved without resorting to German and without pointing attention towards the fact that the exact German translation would be *Querschnittsfläche*.

4.3 Lesson design and topics

4.3.1 Teaching matter

Categorising the subject matter of the lessons into topics centred around content instruction, language learning, intercultural competences and integrated forms yields the most striking results: The vast majority of topics is clearly content-centred, there is only one explicit language learning phase to be found throughout the material, and only two lessons contained truly integrative forms of teaching language and content. Moreover, teaching activities aimed at developing intercultural competence have not been found at all. The exact figures are given in table 4.3.1:

<i>Topic category</i>	<i>Intervals</i>	<i>Percentage</i>
Mainly content work	2986	85,4
Mainly language work	10	0,3
Content and language integrated	40	1,1
Intercultural competences	0	0
Regulative / organisational	309	8,9
off-topic	84	2,4
other	68	1,9

Table 4.3.1: Distribution of topic categories

Of the two activities which qualified as genuine content and language integrated learning activities, one was found in lesson B2. Here, the teacher managed to combine a vocabulary learning activity with the topic of energy transformation: After a brief introduction, the students had to come up with devices or appliances which either generate electric energy or require it. The terms they brought up were written on the blackboard in the appropriate column. Naturally, the pupils came up with a great number of examples for both categories, but often lacked the correct English name. This led to a few Negotiations, but in most cases the teachers helped by offering translations from German. After a number of terms had been found, the teacher handed out slips of transparencies showing images of various electric appliances to individual pupils. The pupils then had to show the image to the class using the projector, in order to jointly come up with the appropriate English term for the object shown:

Transcript 4.3.1, from lesson D2

- (S1 had been given an image of a power outlet)
- S1 Ah, eine Steckdose! (Ah, an outlet)
- CT Yes... do you know the English word for it?
- NS -- There's an English word!
- S1 Hmmm... maybe... (...)
- S2 current?
- CT current is "Strom", everything has to do with "Strom", but (-) "Steckdose"?
- S3 Connector?
- CT Connector, ein Verbinder? Mmm, no! (...) Steckdose, weiss es jemand? ("Steckdose", anybody knows?)
- (...)
- NS Yeah okay, but what's the word for "Steckdose"? That's the question.
- CT Wissts ihrs - vielleicht habt ihr's schon in English gemacht? (Do you know? Maybe you've already done it in the English lessons?)
- S4 (pronouncing in an English way) "Steckdose"
- CT Okay, new word for you...
- [...]
- NS No, it's an outlet, or an electric outlet!
-

This way, the learners were confronted with quite a number of new terms, albeit only nouns, with which they actively engaged in order to solve the actual task of finding electrical appliances and assigning them to the two categories given.

The other activity occurred in lesson A2. Here, the students had to read a German text about how Alexander Graham Bell tried to locate a bullet in a person's body using a makeshift hall effect sensor and then one student was asked to summarise it in English. During the summary, a few Negotiations occurred because of some language problems:

Transcript 4.3.2, from lesson A2

-
- S1 (-) Well, Mister Bell, Mister Graham, Alexander Graham Bell
- NS --Mhm.
- S1 (-) wanted to find a (-)... (-)... sphere? (laughs) (note: English "bullet" and "sphere" both translate to German "Kugel")
- NS Ja! (laughs) - bullet, yeah, a bullet.
- S1 (-) okay, in the body of a (-) assassinated... person who wasn't dead yet.
- NS Mhm!
- S1 (-)
- NS --Well, not "assassinated" because that actually means that he is dead, until he actually dies, it's "attempted assassination", he was trying to kill him.
-

One point raised in the literature reviewed (compare section 2.5.1) is the use of authentic materials in order to confront the students with natural, authentic field-specific language. Such materials were only used in one of the lessons, and the text was not from the area of physics: In lesson F1, the students received a text about risk assessment which dealt with topics such as perceived versus actual risk, and how risk is calculated. There were a number of questions and exercises accompanying the text. The text used quite specific language and offered some basis for discussing and describing graphs, which the teacher took up.

4.3.2 Support strategies

There are various ways the teachers used in order to make their lessons better comprehensible to their students. Naturally, every teacher had his or her unique style of teaching and utilised a variety of different support strategies. All of them seemed to pay explicit attention to speaking loudly and clearly and quite frequently repeated or paraphrased passages that might be difficult for the learners to understand.

One of the most common strategies was code-switching or resorting to the student's L1 (which was German in the majority of cases). Naturally, this was not the case for *Teacher E*, who is a native English speaker. Table 4.3.2 shows the use of German during content phases (i.e. intervals where *Topic* has been coded as either *mainly content work*, *mainly language work*, *content and language integrated* or *intercultural aspects* and *language last used by teacher* has been coded as *German*).

<i>Teacher</i>	<i>Intervals</i>	<i>Total⁹</i>	<i>Percentage</i>
Teacher A	19	495	3,8
Teacher B	8	436	1,8
Teacher C	86	382	22,5
Teacher D	115	801	14,4
Teacher E	0	922	0
<i>Total</i>	228	3036	7,5

Table 4.3.2: Use of German in content phases per teacher

Considering that Teacher C has by far the most use of German during content phases it is important to point out that her classes were the only lower secondary classes of the study, and therefore had the youngest learners, who probably had the greatest difficulties with the foreign languages of all classes.

Surprisingly, the presence of a native speaker seemed to play a special role in aiding understanding, as he often repeated or paraphrased, sometimes even simplified utterances, and, when necessary, subtly and cunningly repaired erroneous expressions by the teacher. Transcripts 4.3.3, 4.3.4 and 4.3.5 from two different lessons illustrate that nicely:

Transcript 4.3.3, from lesson A1

	(the Oersted experiment is being explained)
CT	We have a (...) a wire here and if you (...) let the
NS	if the current passes through the wire.
CT	--if the current passes through you see that the magnetic needles (...) show a force. Ja?
NS	So, the magnetic compass needle is affected by the current passing through the wire.

⁹ total number of intervals coded as content phases (compare 4.3.2)

Transcript 4.3.4, from lesson A1

- (The teacher is explaining a transparency showing a cross-section view of a live wire surrounded by iron filings, the filings forming concentric circles around the wire)
- CT The direction of the current is out of the wall (indicates the direction of the current with his hands), so you see there are concentric (...) a concentric field...
- NS Yeah, concentric circles, so you got a wire coming directly out of the wall, right, if it were directly out of the wall, the magnetic field would look something like that.
-

Transcript 4.3.5, from lesson C3

- (the concept of *current* had just been reviewed, and it has been made clear that the current stays the same in a simple closed circuit)
- S1 Frau Professor, also der /'karent/... current bleibt immer gleich? ("Miss, so the current is always the same?)
- NS Mhm - the current stays the same!
- CT --In a simple circuit, okay?
- S2 Es kommt nur drauf an, ob Elektronen verloren gehen, oder? (It only depends on whether electrons are lost, doesn't it?)
- CT Current is the flow of charge, okay? (...) but the charges they don't have the possibility to disappear suddenly... okay? They all stay here in the circuit.
- NS Even though electrical energy is converted, you don't lose any charge anywhere in the circuit, so these are kind of different, different terms.
-

4.4 Communication, interaction and student floor time

4.4.1 Distribution of interaction formats

Naturally, the teachers used a wide range of different interactive formats, the by far most common of which was the *interactive* format. In addition, and with the sole exception of longer student turns in presentations, all of the other formats also came to use quite frequently, as can be seen from table 4.4.1:

<i>Interaction Format</i>	<i>Intervals</i>	<i>Percentage</i>
Lecture	755	21,6
Dictation	257	7,3
Interactive	1238	35,4
Silent work	706	20,2
Group/ partner work	376	10,7
Student presentation	27	0,8
other	137	3,9

Table 4.4.1: Distribution of interaction formats

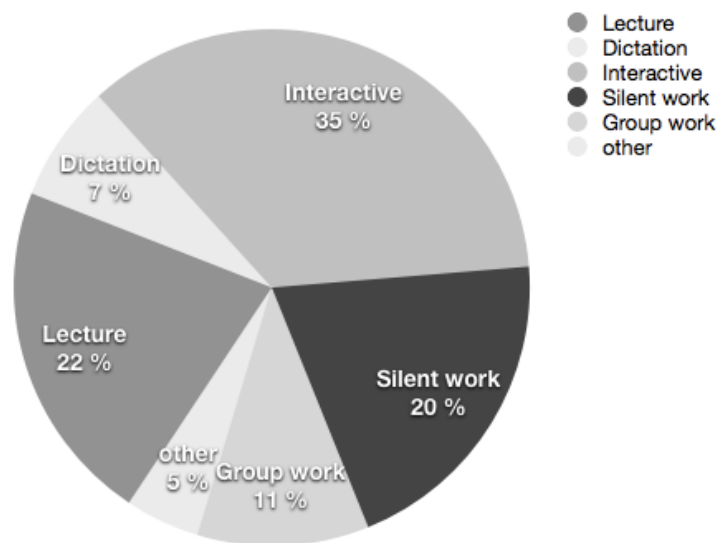


Diagram 4.4.1: Distribution of interaction formats ("Student presentation" treated as "other", labels added for clarity)

An itemisation of interaction formats by lessons provides some additional insight into teaching styles and lesson design. It can be seen that that in the great majority of lessons, teachers used at least three different interaction formats and that all but one lesson had interactive phases. The same is true for the lecture format, as there is also only one lesson where no teacher lecture of some sort took place. However, both of these lessons were, as can be seen from the data, focussed on group or individual work.

<i>Lesson</i>	<i>Lecture</i>	<i>Dictation</i>	<i>Interactive</i>	<i>Silent w.</i>	<i>Group w.</i>
A1	32,7	6,5	60,4	0	0
A2	17,0	0	39,7	42,4	0
B1	49,8	22,6	26,6	0	0
B2	38,1	8,3	29,1	6,47	2,5
B3	47,2	27,9	9,2	6,9	0
C1	5,3	0	0	0	86,7
C3	11,9	0	49,8	0	36,5
D1	10,3	0	80,1	0,1	0
D2	13,9	7,3	42,7	0	30,3
E1	11,3	0	37,1	51,6	0
E2	0	0	28,6	57,9	8,5
F1	11,7	17,7	10,6	56,2	0
F2	22,0	0	38,8	37,4	0

Table 4.4.2: Interaction formats per lesson (percentage of total intervals per lesson; "other" and "presentation"¹⁰ omitted)

4.4.2 IRF structures

As already mentioned, triadic dialogue is a widely used teaching format the effectiveness of which still is subject to discussion. Although not all intervals coded as *interactive* necessarily contain triadic dialogue, the basic structures are still present in such phases and there are, naturally, a lot of IRF structures to be found in the videotaped lessons. These structures seem to occur in a wide range of different teaching situations, but are most popular during revision phases, as can be seen from the figures in table 4.4.3:

<i>Phase</i>	<i>Intervals</i>	<i>Percentage</i>
Revision	447	65,8
New Content	261	22,5
Practice / Application	340	30,1
Summary	18	16,7
other	172	40,8

Table 4.4.3: Use of interactive teaching formats per lesson phase¹¹

¹⁰ *presentation* omitted as only a total of 27 intervals distributed over only two instances of student presentations were found.

¹¹ *Intervals* gives the number of intervals from the respective phase where [IntForm] has been coded as *interactive*, *Percentage* gives the ratio of these intervals to the total number of intervals recorded for that particular phase.

Therefore, even though interactive teaching formats are quite similar, as they basically are a form of providing opportunity for, or even requiring, active learner involvement and learner output, the teaching situations they can come to use in are quite different. Consequently, many features of IRF structures depend heavily on the context.

To name the most important points, the purposes of and expected responses to teacher initiation, their impact on student assessment and the learners' readiness to participate are, for instance, inherently different in revision and content learning phases. As a consequence, all three moves of triadic dialogue must be analysed against the background of these contextual factors.

In the following two cases, both from lesson D2, a lower secondary class on the basics of electric energy, the teachers used a question - based approach to work out how electric devices convert energy. In the first example, the possible learner responses are quite limited, while in the second one, a lot of different answers would be possible:

Transcript 4.4.1, from lesson D2

- NS (holding up a torch and a battery) In my hands I have two items, they are?
- STs (...) torch(?)
- NS A torch, you can say a torch... or?
- Sts --(...)
- NS A torch? Or you can also, that's for British English, and since I'm from California maybe we can say the American word, torch, there's nothing wrong with torch, but, what's the other, do you know the American word for it?
-

Transcript 4.4.2, from lesson D2

- NS Now, I have a flashlight and a battery, they both have to do something with electricity, what's the difference between the two? Anyone can tell me what the difference is? ... [S1]?
- S1 (-) The one, (-) the flashlight needs the energy from the battery.
- NS The flashlight needs the energy from the battery, okay, excellent! ...Good, I like that, what else?
-

In the following example, the teacher expected the learners to interpret certain features of a graph comparing peoples' estimates on the number of deaths from various causes to the actual statistically determined numbers. Not only did the learners seem quite involved and motivated to contribute, but also did the teacher manage to use the F - move to collect student ideas, reformulate them into a clear and precise statement which she then repeated for the whole class:

Transcript 4.4.3, from F2

- CT Okay, so straight line in figure two is a plot of Y equals X, for this graph; okay, which is... Y equals X is when what and what are ...the same? Look at the graph and tell me what it means!
- STs --(...) and the estimations (...) on the Y and X axis (...)
- CT Alright, the numbers are the same so, what do you say is the same here?
- STs (...) the expectations (...)
- CT Alright, expectation matches reality if Y equals X!
- [...] (some time has passed in which the students worked on a number of questions about the graph, now the results are being compared)
- CT So what we are saying is if you're on the line then, if it lies on the line (...) your estimate and reality are the same. So, if it's on the left of the line?
- STs Estimate (...) estimated too high (...)
- CT Right, people are over-estimating!
-

In another lesson, the class was comparing results from an experiment they conducted in a previous lesson. Here, the teacher naturally expects rather precise answers and that every student should be able to contribute, as each of them had participated in the experiment:

Transcript 4.4.4, from lesson C2

- CT Was there another information you could read off the diagram?
- S1 That the voltage and the current are not proportional to each other (...)
- CT --In which case?
- S1 When there is a bulb.
- CT Okay. (while writing on blackboard) Bulb - voltage and current are not proportional.
-

During revision phases, the teacher most likely expects similarly precise responses, as the learners are supposed to already know the answers to the teacher's questions. In addition, failing to provide the correct answer might have a negative impact on the student's overall assessment. During the following revision phase, the teacher chose the pupil to answer the question by herself and was quite quick in doing so:

Transcript 4.4.5, from lesson E1

CT [S1], some types of energy? ... That we talked about?
S1 --kinetic energy.
CT Kinetic energy, another one?
S1 Potential en--
CT --Potential.
S2 heat
CT Heat energy. Another one?

As previously mentioned, not all intervals coded as *interactive* necessarily contained IRF patterns. In like manner, IRF patterns were not exclusive to explicitly interactive teaching forms. Instead, IRF patterns, albeit mostly isolated ones, also occurred during lectures or dictations, when the teacher decided to briefly involve the students, most likely for reasons such as to check understanding, revise important information or simply to raise attention, as can be seen from the example in transcript 4.4.6:

Transcript 4.4.6, from lesson E1

CT So, we have two formulae which I think we have already mentioned earlier: Kinetic energy, can be measured from its mass, velocity okay, was half $m \cdot v$ squared. Okay, that's the formula we've already mentioned. "v" stands for what?
STs (...)
CT v stands for?
STs (...) ity
CT Velocity. What's the difference between velocity and speed?
(many students raise their hands)
CT [S1]?
S1 Velocity has a direction and speed doesn't.
CT Excellent. Velocity has a direction, okay, speed doesn't.

So, all in all, IRF patterns seem to be very diverse, used in a wide range of settings with a similarly wide range of purposes.

4.4.3 *Student floor time*

Because it is recorded for every coded interval whether the students were silent or there was somebody speaking, it is possible to draw conclusions as to how much opportunity for active student participation (i.e. phases where students "have the floor") the lessons offer, and which phases and interaction formats seem to foster such opportunity for output. It is, however, important to note that here, only spoken interaction between single (or small groups of) students with the teacher or native speaker assistant were treated as student talk time. Learner-learner interaction in group work phases was not coded as student talk time. (compare section 3.5) Hence, student talk time recorded in group work phases is solely limited to interactions with one of the teachers (when the pupils are asking questions, or the teacher is checking progress). Additionally, there is some uncertainty to the actual amount of student talk time, as an interval coded as containing student talk does not necessarily feature student talk for its full length of ten seconds. In other words, a value of 30 per cent means, that one or more learners spoke to the teacher in 30 per cent of all intervals, not that pupils had the floor for 30 per cent of the total lesson time.

Generally speaking, the videotaped lessons seem to contain a good deal of opportunity for spoken learner output (i.e. intervals coded with *language used by student* as either *English*, *German* or *other*), as about one out of four intervals contained some sort of student speech. Table 4.4.4 provides an overview on student floor time for each of the lessons. It is easy to notice that the value differs greatly from lesson to lesson, as it ranges from just 9 to over 70 per cent of student floor time.

<i>Lesson</i>	<i>Intervals</i>	<i>Percentage</i>
A1	53	20,4
A2	83	32,3
B1	30	10,9
B2	73	26,3
B3	29	9,5
C1	17	9,0
C3	149	53,8
D1	202	71,9
D2	75	27,4
E1	50	18,2
E2	41	15,8
F1	32	11,3
F2	52	18,2
<i>Total</i>	<i>886</i>	<i>25,3</i>

Table 4.4.4: Student floor time per lesson and total

Tables 4.4.5 and 4.4.6 (along with their respective diagrams) show student floor time in different interaction formats as well as lesson phases, along with the *Percentage* that student floor time makes up in the respective format or phase.

<i>Interaction format</i>	<i>Intervals</i>	<i>Percentage</i>
Lecture	65	8,6
Dictation	13	5,1
Interactive	519	41,9
Silent work	72	10,2
Group / Partner work	111	29,5
Student presentation	27	100
other	24	17,5

Table 4.4.5: Distribution of student floor time over interaction formats

<i>Phase</i>	<i>Intervals</i>	<i>Percentage</i>
Revision	364	53,6
New content	154	13,3
Practice / Application	186	16,5
Summary	17	15,7
other	110	26,1

Table 4.4.6: Distribution of student floor time over lesson phases

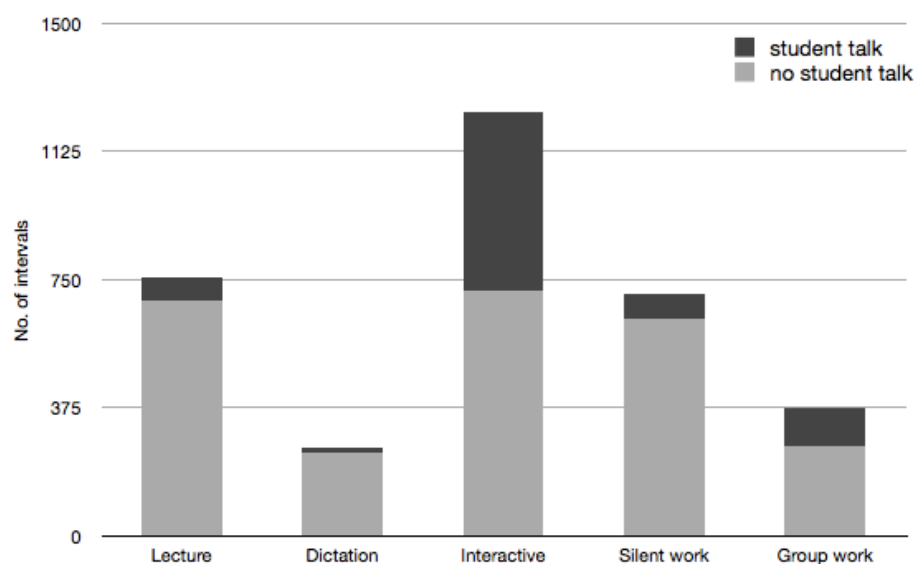


Diagram 4.4.5: Distribution of student floor time over interaction formats

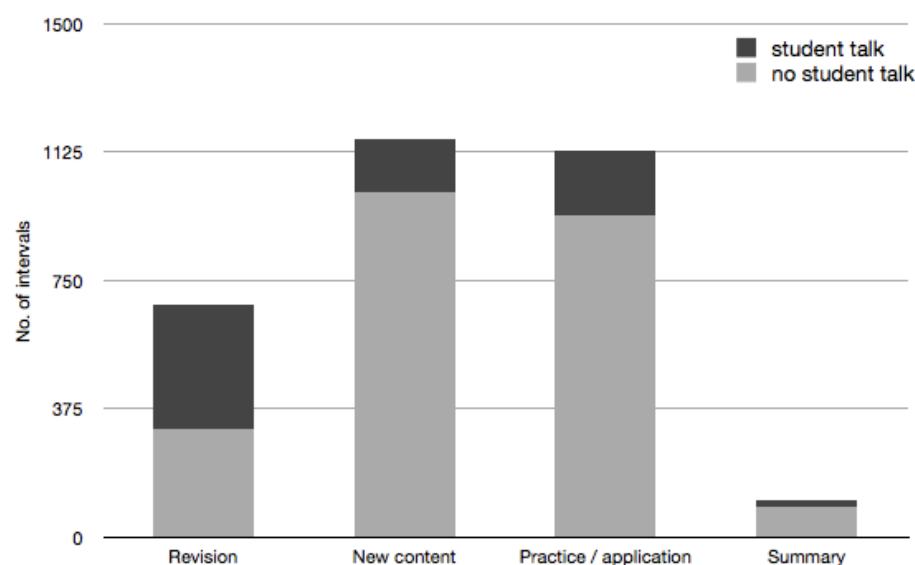


Diagram 4.4.6: Distribution of student floor time over lesson phases

Obviously, interactive teaching phases provide most opportunity for student output, as can easily be seen from the table. (With the sole exception of student presentation phases which self-evidently consist solely of student talk time) Considering the fact that almost two thirds of all *interactive* intervals are revision phases (compare table 4.4.3) it is also not surprising that revision phases feature by far the most student floor time. Dictations, on the other hand, seem to offer the least opportunity for the learners to engage in spoken interaction. Between content learning, practice, application or summary phases, however, there seems to be almost no difference concerning the occurrence of student talk.

4.4.4 Language use in interaction

As has already been discussed, the teachers did not exclusively keep to English but decided to use German at several occasions. The same is, naturally, true for the students who also resorted to German in some situations. Table 4.4.7 shows the language used by students as intervals and as a percentage of the total number of student floor time intervals per lesson.

<i>Lesson</i>	<i>English</i>	<i>German</i>
A1	27 (50,9%)	26 (49,1%)
A2	73 (90,1%)	8 (9,9%)
B1	14 (46,7%)	16 (53,3%)
B2	29 (39,7%)	44 (60,3%)
B3	0 (0%)	21 (100%)
C1	14 (82,4%)	3 (17,6%)
C3	99 (85,3%)	17 (14,7%)
D1	88 (43,6%)	114 (56,4%)
D2	61 (82,4%)	13 (17,6%)
E1	50 (100%)	0 (0%)
E2	41 (100%)	0 (0%)
F1	21 (100%)	0 (0%)
F2	52 (100%)	0 (0%)
<i>Total</i>	<i>569 (68,5%)</i>	<i>262 (31,5%)</i>

Table 4.4.7: Language use by students as intervals and percentage of total student floor time per lesson

Obviously, all of the four lessons in which the students did not use any German in interacting with the teacher at all were all held by Teacher E, who is a native English speaker. Although she does understand German (but never uses it in class) the students seemed to never address her in German.

That the language the teacher uses greatly influences the language chosen by the pupils can be seen when comparing the variables for *language last used by teacher* and *language used by student* for each interval, as shown in table 4.4.8. A comparison like this is possible, because *language last used by teacher* is always coded and refers to the last utterance of the active teacher (compare section 3.5). So even in longer student turns or when the answer of the student occurs in a later interval than the initiation of the teacher, the relation remains accurate.

<i>Language use (teacher / student)</i>	<i>Intervals</i>	<i>Percentage</i>
English / English	563	67,8
German / German	160	21,7
English / German	101	12,2
German / English	6	0,7

Table 4.4.8: Teacher / student language use in interaction over all lessons as intervals and percentage of all intervals containing student talk

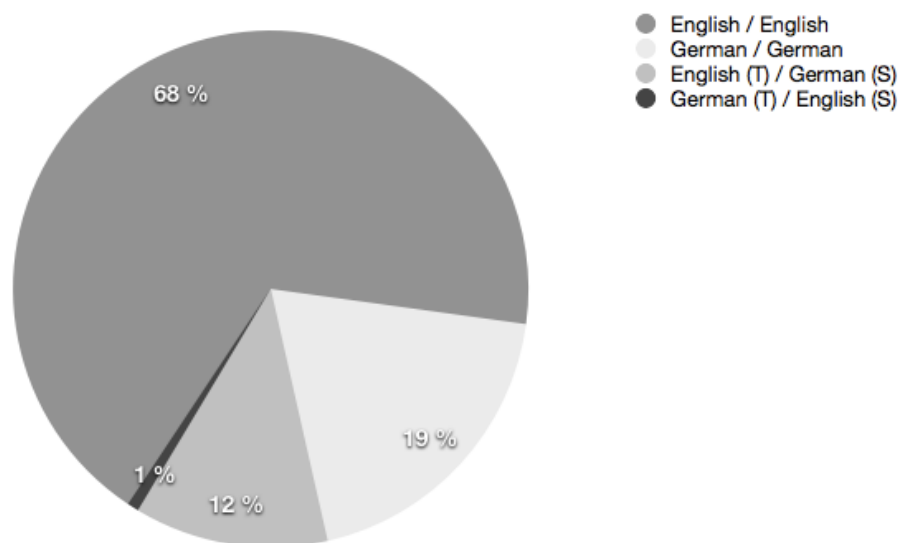


Diagram 4.4.8: Teacher / student language use in interaction

As can be seen from the data, students are most likely to use English if the teacher uses English as well. In like manner, as soon as the teacher switches to German, students will most likely also use German. Nevertheless, in about twelve per cent of all recorded intervals featuring student talk, the learners did address the teacher in German, even though the teacher was or had been using English.

4.5 Teacher interviews

The interviews are analysed according to the four main points *Institutional background*, *Learner performance and motivation*, *Learner background*, and *(teacher) Motivation for CLIL* (compare section 3.2.3) separately for each teacher. As to avoid redundancy, for those teachers who are teaching in the same school (Teacher A, B, and C all teach in School A) only Teacher C was interviewed on the institutional background of their school. Statements about socio- economical background or other context factors of the learners only relating to the students of the recorded classes are stated under *learner background*, while those stated under *institutional background* apply to all students of the school in general.

4.5.1 Teacher A

4.5.1.1 Institutional background

see Teacher C (section 4.5.3)

4.5.1.2 Learner background

Teacher A isn't aware of any bilingual background some the students might have and, at the time of the interview, had not known the class long enough to give a statement about the socio-economical background of the students.

4.5.1.3 Learner performance and motivation

Teacher A states that he was actually surprised of the vocabulary the learners (age 16-17) have built up over the years of enjoying CLIL instruction. He also reports that in the first lessons he taught in English, the students almost exclusively used German responding to questions asked in English, which began to change after a few lessons. Interestingly, this is exactly what he was told by his colleagues who already had some CLIL experience.

Concerning motivation, Teacher A believes that what students enjoy most about CLIL instruction is the presence of the native speaker, which they experience as a welcome change to regular instruction. He also believes that, at least some of, the pupils are aware of the benefits they can gain from the CLIL lessons.

The differences in learner behaviour between instruction in L1 and L2 are quite diverse. There are some pupils who seem to be more eager to participate In CLIL lessons. In like manner, there are some who involve themselves less, and for others Teacher A doesn't notice any change at all.

4.5.1.4 Motivation for teaching CLIL

Teacher A reports that he was asked whether he felt capable to teach some of his physics lessons in English, which he agreed to. He says that although he needs to put definitely more effort into the preparation of CLIL lessons, having the native speaker assist him in class is of great help to him.

4.5.2 Teacher B

4.5.2.1 Institutional background

see Teacher C (section 4.5.3)

4.5.2.2 Learner background

When the interview was carried out, Teacher B was not quite familiar with the class yet, so she only knows the background of a few individual students and cannot really give a general account.

4.5.2.3 Learner performance and motivation

Individual student performance in the CLIL lessons differs greatly, which becomes especially apparent when it comes to output: While some students are quite ready to involve themselves and interact quite competently and fluently with the teachers, there are others who experience great difficulties in expressing what they want to say. For the latter group, the main problem appears to really be the language. There is, for instance, one student whose performance in Physics is actually very good and who is always eager to involve herself when the lessons are held in L1, but is rather quiet and reluctant whenever the lessons are taught in English. On the other hand, there is another student for whom the exact opposite is the case: Although she is rather good and active student in the regular physics classes, it is in the CLIL lessons where she becomes even more dedicated and active. She says herself that she very much likes the use of English in the physics lessons and that she greatly enjoys expressing herself in English.

Concerning general performance, most of the class' teachers, including Teacher B, made the observation that overall motivation and performance has dropped since the beginning of the school year. The teachers are still unsure about the reasons for that development.

During the first topic she taught in English, Teacher B made the experience that the students as a whole had some problems understanding the subject content of the lessons. She believes that this might actually be due to hers not being able to express herself as precisely as she normally would in German.

There is, according to Teacher B, not much feedback from the students concerning the use of English. There were only a few occasions where some of the pupils reacted with delight when they saw the native speaker accompanying her into the classroom, indicating that the lesson is going to be in English. Teacher B also has the feeling that most of the learners are aware of the benefits of CLIL and of the importance of having a good control of English.

4.5.2.4 Motivation for CLIL

Teacher B was simply approached by the headmaster and asked whether she was willing and felt capable to teach some of her physics classes in English, which she agreed to because she thought it was beneficial to the learners. And although she enjoys teaching CLIL classes, she also acknowledges that it definitely means more work and thought needs to be put into planning, preparing and organising the lessons.

4.5.3 Teacher C

4.5.3.1 Institutional background

Teacher C's school (School A) is a lower and upper secondary school, with different foci, one of which is CLIL instruction starting already in lower secondary. They have laptop classes and courses oriented on new pedagogical concepts such as unrestricted learning.

There are no formal entry tests, the pupils are, however, selected according to the distance they live from the school and their marks from previous schools. Each year, several applicants are rejected, so the pupils are generally rather higher performers.

Concerning CLIL, there are so-called "orientation talks" with the pupils and their parents in which they are informed about the demands of CLIL teaching and the required language competence. It is tried to find out whether the respective student is motivated in and capable of participating in CLIL instruction. On the side of the teachers, there are no formal requirements, instead, the teachers in question can decide for themselves whether they feel capable enough to teach their subject, at least partly, in English. However, there are only a few teachers involved in CLIL teaching and they are of rather mixed age.

4.5.3.2 Learner background

Teacher C's CLIL Physics class consists of mostly high-performing pupils with excellent preconditions. The great majority are children of academics, some of them even have a bilingual background. In addition to that, the majority already had great background

knowledge at the start of the course. One student, for instance, already knew what a *vacuum chamber* was and asked if they are going to do experiments involving one.

4.5.3.3 Learner performance and motivation

Teacher C's general impression is that the students experience only minor problems with the use of the foreign language and the subject content of the lessons, she believes, however, that this is mostly due because of the learners' background. (see below) The learners seem to enjoy the CLIL lessons greatly although they are probably too young to be fully aware of its benefits. There is not much feedback from the learners, but Teacher C believes that the absence of complaint is a good indicator for the students liking their CLIL Physics lessons.

Interestingly, the greatest difference between regular teaching and the CLIL classes is not, to her experience, found inside the classroom but actually in the preparation and administrative work. Firstly, the use of a native speaker must be justified and organised beforehand, as their resources are limited. Secondly, preparing CLIL teaching also involves locating and obtaining specific teaching material such as English textbooks and worksheets. Additionally, post-teaching reflection is very important, as issues like the choice of topics and materials should be evaluated.

4.5.3.4 Motivation for CLIL

Teacher C started teaching CLIL mainly because the opportunity arose and she was very interested in it. Today she enjoys teaching her subjects in English a lot and experiences only little difficulty.

4.5.4 Teacher D

4.5.4.1 Institutional background

Teacher D teaches CLIL classes in School B's separate CLIL branch. Students in the same year of study attending this CLIL branch are joined together in one class -or if the demand is high enough two or more classes- and are enjoying CLIL instruction in a wide range of subjects (about half the subjects of the curriculum, the number depending primarily on the availability of teachers and native speakers). In other words, the CLIL students are separated from the regular students during instruction which is on offer both in English and in German, but can be in the same groups with other students in some of the other subjects, especially subjects like P.E.. Additionally, great effort is made to bring the students of both branches together at certain school events and activities.

Students wishing to attend the CLIL branch are required to have an "orientation talk" with English teachers and the school's native speakers who decide whether their language competence allows them to successfully participate in CLIL classes.

The CLIL lessons are taught either by teams consisting of a subject teacher and a native speaker or by (regular) subject teachers who are competent in English. In the majority of cases, the latter group are also trained English language teachers, still, there are, including Teacher D, some teachers who have no explicit training in the area of language or language instruction but are nevertheless considered competent because of other reasons. In all cases, the headmaster, who takes great care in choosing suitable teachers, has to decide whether a teacher has sufficient language skills to be considered capable of teaching CLIL classes.

4.5.4.2 Learner background

While the students attending School B's regular (i.e. non-CLIL) classes are mainly young people from the vicinity of the school, the majority of CLIL students, or their parents, consciously chose this school especially because of the CLIL branch. Hence, the parents, and also the students themselves, are very much aware of the additional value CLIL instruction can provide, and especially of the value and importance of education -as opposed to vocational training- in general.

4.5.4.3 Learner performance and motivation

Considering the background of the school's CLIL branch, it is no surprise that Teacher B describes the CLIL students mainly as generally motivated, interested and rather competent in their language skills, an observation that I can only confirm from my time spent with the class and the recorded material. Additionally, the school is keeping track of and comparing students' performances of both the regular and the CLIL branches continuously. From these records, Teacher D reports, it can be seen that the CLIL students achieve, save a few exceptions, slightly better results than their peers from the regular branches.

However, if there is a causal relation between CLIL instruction and the students' better performances in this case remains highly speculative, as the CLIL students -as has been said- mostly have a very positive attitude towards learning and education in general and have also already been selected according to their language skills.

Nevertheless, Teacher D reports to repeatedly have gotten feedback from the students expressing their very positive attitude towards CLIL instruction itself, and that they believe

that its additional value will benefit them in their further training and careers. In other words, they see CLIL instruction as enriching and rewarding.

Interestingly, a majority of the students does not seem to have great problems using English as the primary classroom language. Teacher D attributes that not only to the fact that the students of the CLIL branches necessarily have good English language skills, not least because of the orientation talks, but also to the great amount of CLIL instruction they are receiving. He reports that the use of the foreign language quickly becomes routine for the students, and that, at a certain point, some of them don't even consciously distinguish between using English or German anymore.

4.5.4.4 *Motivation for CLIL*

Teacher D states that he, while being a trained science teacher, also has great interest in the English language. Naturally, CLIL teaching allows him to combine those two interests in his daily work. Additionally he is convinced that, as English is not only an -if not *the*-international lingua franca¹², but also the language of the international scientific community and international academic discourse, it is essential to provide students with profound English language skills if they are going to be well-prepared for university education and a possible academic career.

Although Teacher D is not a trained language teacher, he has mastered English at a highly proficient level and has already gathered experience teaching science subjects in the United States. Naturally, he feels more than qualified for teaching Physics in an Austrian CLIL context.

The only aspect he found challenging, however, was learning and getting accustomed to the English specialised and technical terminology, mainly because he had until then never been confronted with them, as Physics was not among the subjects he had already taught in the States.

Teacher D says that he enjoys CLIL teaching very much and that he thinks it is a highly valuable and rewarding means of instruction promising many benefits for the students.

¹² the term *lingua franca* refers to a second or foreign language used by two interlocutors who do not share the same L1 to enable communication.

4.5.5 Teacher E

4.5.5.1 Institutional background

Teacher E's school (School C) is an upper and lower secondary school with the lower secondary being a school pilot project aimed at providing a combination of the two regular branches of lower secondary education in Austria: the "Gymnasium-Unterstufe" and the "Hauptschule". While this is mostly not relevant to the lessons analysed for this study (which were in two upper secondary classes) it nevertheless might indicate that there is a greater mix in the social backgrounds and abilities of the pupils which graduate lower secondary and move on to the upper secondary within the same school.

Very much like Teacher D's school, Teacher E's school also has a separate CLIL branch, the students of which are pooled in one additional class per school year. This class then enjoys CLIL instruction of 9-13 lessons a week, the actual number again depending on the number of native speakers or teachers available. Again, students are required to have an orientation talk in order to determine whether their linguistic abilities qualify them for a participation in the CLIL branch.

4.5.5.2 Learner background

The social background of School E's, especially the CLIL branch's pupils, is extremely diverse. It ranges from children of parents who are English native speakers working for the United Nations (UN) in Vienna to children which are just living quite close to the school. The same is true for the linguistic background of the students: For many, German is not their L1, but, interestingly, neither is English. Instead, there are, according to Teacher E, a lot of students who have English as a "second first language", that is, who have been introduced to English at a very early stage alongside their actual L1, which is different to German in many of the cases. Additionally, some of the students who have an L1 different to English or German actually use a multitude of languages, often including English and German, in their daily lives. For instance, a student might use German when conversing with friends at school, Hindi for talking to her sister and English when talking to her parents. In short, multilingualism is quite common amongst School C's CLIL students.

4.5.5.3 Learner performance and motivation

While Teacher E makes out a few problems with general motivation, the use of English does not seem to pose a problem for the great majority of the CLIL students, which can easily be seen from classroom participation and also from student feedback. However, Teacher E actually reports that the only situation where the learners do sometimes complain about the

additional challenge is when they try to find an excuse for failing a test or the like, blaming the additional difficulties which arise due to the use of English as the cause of their failure.

Teacher E does not have the impression that many of the students are aware of potential benefits of enjoying CLIL instruction, but she attributes that mainly to their age, expecting them to recognise the advantages as they are getting older.

4.5.5.4 Motivation for CLIL

As a native speaker of English, Teacher E has no special motivation for teaching CLIL, but enjoys it nonetheless.

4.6 Comparison to the IPN study

4.6.1 Preliminary remarks

As parts of this study, especially some of the coding variables and values are based on the ones introduced by Seidel and her colleagues (compare Seidel 2003: 114; Seidel et al. 2002: 60-64) in the IPN study, it is only logical attempting to compare the results of both studies where possible and sensible.

There are, of course certain limitations to such a comparison. First of all, the variables and values used for this study are only based on, or inspired by, Seidel's variables. Therefore the definitions and coding guidelines used for both studies are slightly different from each other, necessarily leading to a different treatment of the material. Furthermore, Seidel's numbers must be considered far more precise as they did not only analyse one, but up to ten lessons with different teachers for each of the lesson topics, averaging over all the lessons on one particular topic. Additionally, the lessons in their study were only 45 minutes as compared to the 50 minute lessons analysed for my thesis. Consequently, and in order to simplify comparison, all values will be converted into percentages of total lesson time. In doing so, however, another factor of error is added: As, for this study, the material was coded in ten-second samples, treating a percentage of the total number of intervals as a percentage of total lesson time must be considered inaccurate, as some of the coded intervals will not feature the coded property for its full length of ten seconds. Bearing these limitations in mind, a comparison between the results of both studies still remains sound, and can yield interesting and meaningful results.

4.6.2 Comparisons

Seidel et al. (2002: 61) report that the lessons they analysed were characterised by a dominance of what they labelled *Klassengespräch* ("class conversation", translation mine), which encompasses, albeit not entirely, both the *Interactive* teaching format as well as the *Lecture* format of this study. They found a mean value of 26,6 minutes of *class conversation* in their lessons, which corresponds to about 58,2 per cent of the total lesson time. Added together, *Teacher lecture* (21,6 %) and *Interactive* (35,4 %) interaction formats from my study make up 57 per cent of all coded intervals (and thus, within the above discussed margin of error, also of the whole lesson time). In like manner, student work phases, that is, individual silent work and partner or group work added together, amount to an average of 31,3 per cent in the IPN results, which is almost identical to the 31,0 per cent found in my study (Intervals where [IntForm] was coded as either *Silent work* or *Partner / Group work*). However, while

the total amount of student work phases are very similar in both studies, individual work is much more frequent in my study, with 20,2 per cent of all coded intervals as opposed to an average of only 8,9 per cent of the total lesson time in the IPN study. Self evidently, the opposite is then the case for group work phases, which are substantially more frequent in the IPN data (My study: 10,8 %; IPN: 22,4 %).

Concerning lesson phases, Seidel et al. (2002: 63) found that the focus clearly was on the introduction of new content ("Lernen neuer Inhalte"), with an average of 11,3 minutes¹³ per lesson, amounting to 25,1 per cent of the total lesson time. The value is slightly greater in my data, with 33,2 per cent of all coded intervals being coded as *New content* phases. Revising content that has already been learnt makes up an average of 12,4 per cent of the lesson time in the IPN data, a value which is comparable to the 19,4 per cent of all coded intervals in my study. Concerning the summarising of newly acquired content, the values differ greatly between the two studies, however: While Seidel et al. found an average of 18,2 per cent of lesson time were being used on summarising, only 3,1 per cent of all coded intervals were coded as *Summary* in my study.

It is, however, important to point out, that the IPN researchers treated experiments as a separate lesson phase, a strategy not taken up in my study. Instead, experiments were coded like any other teaching activity either as *New Content*, *Revision*, *Practice / Application* or *Summary* according to their presumed function. The fact that experiments make up a great part of the lessons in the IPN data (a mean value of 26,4 per cent of lesson time), might explain why the values for lesson phases in my study are, with the exception of the *Summary* phase, consistently higher than in the IPN data.

¹³ Seidel et al. make an additional distinction according to whether a particular lesson phase appeared during teacher-centred activities or during student work situations. As a distinction like this is not made in my study, their values are simply added together to arrive at the total time of the respective lesson phase.

5 Discussion

5.1 Recommendations for good CLIL teaching

A substantial amount of recommendations and guidelines for CLIL practice has been presented and discussed, and one aim of this study was to analyse to what extent these recommendations can be found in actual classroom practice.

5.1.1 *Support strategies*

There are a number of suggestions for effective support strategies in CLIL contexts. Among others, one quite prominent one (compare section 2.5.1) is resorting to the students' L1 (German, in the majority of cases). As can be seen from the data in section 4.4.4, most teachers do provide this form of support, with the exception of Teacher E, who is a native English speaker and hence cannot as easily switch between the two languages. It remains questionable, however, if this can really be treated as a disadvantage for her students, as from my experience with her classes, they seem very competent in English and experience little problems communicating effectively. Still, the other teachers do regularly resort to German, especially when the concept discussed is a very complex one or when there appear to be lingering problems with comprehension.

Additionally, and while this was recorded by none of the variables, a general impression which I made was that all teachers more or less frequently used paraphrase and repetition, visual aids, a decrease in pace or spontaneous blackboard drawings in order to support understanding quite naturally. I would argue, however, that most of these aids are not exclusive to CLIL contexts, but should be found in any good science class as well. Moreover, it seems the teachers applied many of these support strategies almost instinctively in order to assist their students with the challenge of the foreign language. After all, most of them are rather self-evident and quite logical measures for reducing comprehension problems and don't require any special expertise in the area of CLIL instruction.

Apart from those just mentioned, there were only isolated examples of explicit support strategies to be found. In none of the lessons were the students given reference material of any sort, such as vocab lists or lists with relevant expressions. Nevertheless, and as far as that can be inferred from plain observation, the students did at no point seem overwhelmed by the use of English or unable to communicate, let alone follow the lesson, which might be due to the

fact that almost all of the students observed are already quite accustomed to CLIL instruction, as has been found in the teacher interviews.

Interestingly, one rather effective type of support, which has not been mentioned in any of the literature reviewed, seems to be the presence of a skilled and dedicated native speaker. As has been discussed in section 4.3.2, the native speaker did a very good job in paraphrasing, simplifying and also, should the need arise, in repairing of the teachers' utterances. This, of course, helps students significantly to follow the lesson. Apparently, as a native speaker of English, he managed to use quite simple language and syntax to formulate even complex ideas, much like the way a trained science teacher can explain highly specific concepts using simple, comprehensible terminology, at least in his or her mother tongue. A science teacher, who has not received special language training, might lack such a skill and hence use unnecessarily complicated or syntactically wrong and therefore hard to follow constructions. Still, the question remains if other native speakers would perform comparably, after all, there was only one particular native speaker assistant in this study.

5.1.2 Language teaching and integrated learning

Literature recommends a certain amount of explicit language teaching in CLIL classes, such as working with authentic texts, presenting and practicing field- and genre-specific vocabulary and expressions for production and output training. From these recommendations, only a few are met.

As can be seen from section 4.3.1, there was only one phase dedicated to explicit language teaching over the whole of the material, and this phase was merely an explicit question phase where the teachers solved language problems with short texts the students had just received. Apart from that, explicit, language learning without any science aspects to it was limited to rare, isolated vocabulary hints.

Nevertheless, two genuine content and language integrating activities were found in the lessons and have been briefly sketched in section 4.3.1. Both of these activities were excellent examples for truly integrative teaching, as here, explicit language learning was realised through content teaching. Of course, a great deal of language learning will undeniably take place during any kind of activity in a CLIL context, still, creating an activity which manages to shift the role of language learning from a mere side benefit to an explicit teaching aim while keeping the actual topic on content instruction, is true integrated learning. Unfortunately, these two activities are the only ones of their kind to be found in the material.

Nevertheless, Teacher D uses two textbooks for his CLIL Physics classes, one in English, the other in German, side by side, and while there was no indication of them being used for comparable activities in any of the lessons observed, the mere fact that both of them are available to the learners and frequently used in class side by side certainly is beneficial for CLIL classes.

Still, the ultimate goal of CLIL instruction should be to actually provide as much true content and language integrated instruction as possible. However, it seems that the lessons observed in this study, although being well- designed, interesting and demanding professional science lessons, do not quite live up to these expectations.

Apart from that, it has also been suggested by the literature reviewed that students should be provided with enough opportunity for, and helpful feedback on, written and spoken output. concerning the latter, the data shows that there is ample opportunity for learner output in more than one context (compare section 4.4.3). There are numerous instances of interactive teaching formats that allow and sometimes even require pupils to actively participate in classroom interaction and hence produce spoken output. The IRF structure which is frequently found in such contexts then serves, as has been discussed, as an effective means of providing immediate, helpful feedback which ranges from mere error correction to repair, scaffolding, paraphrasing and summarising by the teacher. Even more apparent, each lesson featured a good amount of student talk time (only two lessons had less than 10 per cent of all intervals featuring at least one student interacting with the teachers), suggesting that this is a standard already to be found in CLIL classes.

Concerning written output, however, no instance of an activity which required the students to produce some sort of report, essay or other written text was found in the lessons. This also includes homework assignments of any type. Still, there would have been opportunity for assigning such tasks to the learners. For instance, there were a few experiments carried out by the students, for which they could have been required to write a brief report of some sort. Instead, the teachers mostly handed out worksheets that only required filling in of values or giving short answers to questions.

All in all, a few requirements of the language teaching aspect of CLIL instruction are met, but the lessons would most likely benefit from additional activities focussed at one of the topics discussed.

5.1.3 Intercultural aspects

As already mentioned, there was no evidence whatsoever of any teaching activities centred around developing intercultural competence. The focus of the lessons was clearly on content instruction, which, from the authors experience, is typical to most science instruction in Austria. Despite the hypothesis that one of the benefits of CLIL for science contexts could be the development of intercultural competence, no effort was made to facilitate such a development.

5.1.4 Good science teaching

Without going too much into detail, given the rather different focus of this study, I find it sufficient to say that a great deal of the general recommendations and guidelines for science instruction were observed in the vast majority of lessons and situations. The recordings show an abundance of diverse teaching activities, from teacher experiments to group tasks, interactive games involving the whole class, and individual work; but also rather classic teaching styles like lecturing or question-based teaching formats are frequently found in the lessons. In like manner, experiments had clear and transparent goals, were clearly structured and engaging for the learners, and any preconceptions or errors were dealt with in a respectful and productive way. From what can be seen from the recordings, the lessons were, without exception, professional, well-structured, interesting, learner-oriented and often engaging.

5.1.5 Conclusion

Although the recorded lessons were generally well-prepared, nicely structured, professional science lessons which were characterised by the teacher's engagement, scientific knowledge and didactic skills, and a proficient use of English, many of the suggestions and recommendations found in the literature were not, or only partly, observed.

I am convinced that this is due to the lack of training and preparation for CLIL instruction for the respective teachers, a claim, which is not only supported by the data presented on European CLIL practice (compare section 2.2) but also by the teachers themselves (compare section 4.5). All teachers agreed that there was no special training or formal prerequisites for engaging in CLIL teaching, instead, the common notion was that those teachers who felt capable enough, primarily in terms of language skills, were assigned to CLIL classes. Additionally, there are, from my own experience, almost no courses focussing on CLIL instruction on offer during university teacher training, let alone an obligatory introduction to the topic of any kind. Consequently, the teachers, unless they

choose to consult specialist literature by themselves, simply have no chance of knowing that such suggestions and recommendations even exist.

5.2 Negotiation of Meaning

5.2.1 Role in teaching and learning

Negotiation of Meaning has been said to play a pivotal role in language and subject learning alike, and might even be a central element to the success of CLIL (compare section 2.3). And indeed, quite a number of instances of Negotiations were found in the recorded lessons, the analysis of which bears interesting results.

First of all, teacher-initiated Negotiations seem only at first sight to be inherently different from student-initiated ones. The main reason for this seems to be the different purposes the respective initiator is trying to achieve. In almost all cases where the teacher initiated a Negotiation of some sort the goal was to correct or refine a learner's view on a concept. It can be assumed that a learner is, at this stage, not aware of how much his or her understanding of the discussed concept's meaning differs from the teacher's. Without the teacher initiating such a Negotiation, this difference in meaning would persist. When a learner, on the other hand, initiates Negotiation it is because he or she fails to either get meaning across or to grasp the meaning the teacher tries to communicate. In both cases, the main reasons for the obstruction are most likely either the student lacking the language or the appropriate terminology or the student's understanding of the concept not being as clear as necessary to describe, or understand, it in a sufficient way. So, the core of the problem is the same difference in meaning that the respective students and teachers experience. Bridging such gaps in meaning is one of the main goals of good science teaching, as it fosters the development of true understanding.

The way and contexts in which Negotiation emerged in the lessons observed seems to back the claim that Negotiation of Meaning does play a central role in teaching and learning. Its importance is also supported by the fact that those lessons and lesson phases which were centred around rather complex concepts or featured a lot of technical vocabulary experienced the most Negotiation. These Negotiations are a valuable part of classroom interaction, as they not only show the teacher where the main problems with understanding are but at the same time also provide opportunities for immediate intervention. Two excellent examples for such situations have been presented in transcripts 4.2.11 and 4.2.12.

Another reason for student initiated Negotiations which has only briefly been mentioned are problems with language or terminology. In such a case, the learner might have a quite clear understanding of the concept but lacks the appropriate language or technical terminology to communicate their thoughts. A good example for such a situation has been presented in transcript 4.2.7, where the student only managed to express his ideas in drawing, not in language. Such situations are especially in the context of CLIL classes worth further examination.

The presence of a few language-related negotiations implies that the use of English does provide a few obstructions for understanding. However, these obstructions do encourage Negotiation which facilitates further engagement of the learners with the subject matter. And when these Negotiations are managed well by the teacher, they can be associated with similar learning processes as content-related Negotiations, which are not necessarily limited to language learning. As has been said, transcript 4.2.7 illustrates nicely how, through careful scaffolding, the teacher managed to gradually repair the student's weak expressions and incorrect use of technical terminology such as *wavelet* or *wave crest*, before he resorted to drawing. Another case of effective scaffolding leading to learner uptake can be found in the presented transcript of lesson D2 (transcript 4.2.4). In this case, the teacher and the native speaker helped the student find the right words for describing what he already seemed to know to some extent and for forging a connection between the everyday experience that a battery uses acids to store energy in some way and the physically correct description of the transfer from chemical to electric energy. I would argue, however, that comparable situations can as readily arise in regular science instruction as well, as many everyday expressions and terms are not considered scientifically sound and pupils lack the necessary experience and competence to explain concepts in a way that is not only considered correct but also accurate.

However, a weakly managed Negotiation will most likely not lead to learner uptake and subsequent understanding, as can be seen from the example presented in transcript 4.2.6 about the definition of *Voltage*. Here, instead of keeping the Negotiation around the central idea of difference, and trying to help the student define which difference both parties were actually talking about, the teacher brought in a new point from which she tried to deduct the missing information. Eventually, she managed to explain the concept of voltage, which was at the centre of the Negotiation, again, and from a different perspective, which doubtlessly led to

better understanding amongst the students, but the Negotiation itself, strictly speaking, was not resolved.

From the examples presented, one might conclude that scaffolding is indeed a powerful tool in managing Negotiations, as it helped to resolve many Negotiations quite well. Still, it remains questionable how many obstructions hindering understanding actually get negotiated at all. After all, many learners might not readily initiate a Negotiation out of numerous reasons. On the other hand, the fact that the most Negotiations were conducted in lessons or lesson phases where quite complex and abstract concepts were discussed might indicate a certain readiness of the learners to initiate Negotiations when they experience trouble understanding.

There were, naturally, also Negotiations which occurred exclusively because of comprehension problems with the foreign language, such as unknown vocabulary or too complex syntax. And while such Negotiations did only have little value for the content aspect of CLIL lessons, they could have a rather positive impact on language learning. The example from lesson F2 (transcript 4.2.8), for instance, nicely shows how an unknown expression, which is additionally completely irrelevant to Physics, (*to account for* in this case) hindered comprehension of a question, and was subsequently resolved through Negotiation and, most likely lead to the students learning a new expression, which they most likely will have recognised and understood the next time they encountered it. However, a Negotiation like this can also have adverse effects on content, even language learning, as the situation outlined in transcript 4.2.14 illustrates: Here, the term *cross-sectional area* was unknown to a few students, which was resolved by the native speaker offering an explanation, and one student subsequently comparing the term to *thickness*, a comparison the native speaker agreed with. It remains highly questionable, if a thorough understanding of the term has really been reached, as such technical terms carry highly specific meaning, which can usually not be grasped with a brief explanation or a weak comparison to a related, yet inherently different concept (such as *thickness*, in this case). Most likely, the student would already have had a quite clear understanding of the German equivalent *Querschnittsfläche*, therefore it would have been easy to establish a connection to this already existing knowledge by offering the German translation, instead of trying to build understanding of the concept anew in the foreign language.

5.2.2 Occurrences and distribution

First of all, the distribution over lessons and teachers seems to indicate that neither teaching style nor class factor into the occurrence of negotiations. Rather, it seems to depend heavily on the complexity of the content itself, and the learners seem to be quite ready to initiate Negotiation if they experience trouble understanding. What it does depend on, however is teaching context and interaction format. The data suggests that students and teachers are most likely to engage in Negotiation during interactive phases and least likely during dictation. Given the fact that Negotiation of Meaning is part of natural human interaction, it makes perfect sense to assume that interactive teaching formats can provide a fruitful environment for encouraging natural NoM.

In addition, as the majority of Negotiations occurred during revision and summary phases, it is safe to assume that these phases also seem to encourage the appearance of Negotiation. Contrastively, phases in which new content was presented featured the least instances. One of the reasons for that might be that the learners still need to make sense of newly acquired content and are therefore not yet ready to make meaning of it. During summary or revision phases, however, the learners had already had time to develop that meaning and can engage in Negotiation should this meaning conflict with the one discussed by the teacher. Additionally, it is likely that summary and revision phases offer learners a chance to, as their names suggest, revise, rethink, restructure and refine their thoughts and the meaning they have developed and counter-check them with the teacher or their peers. During such processes, differences in meaning are likely to become apparent and can subsequently be discussed.

It can be concluded that summary and revision (without any assessment character) as well as interactive teaching formats play an important role in meaning making. Hence, much lesson time should be dedicated to these phases and effort made to engage the learners in interactive teaching forms. However, and despite their importance, not much lesson time is, compared to teaching of new content, spent on revising and even less on summarising. (compare table 4.2.3)

5.3 Communication and interaction

5.3.1 *Triadic dialogue*

Concerning triadic dialogue, two controversial views on the subject have been outlined: Firstly, some scholars believe that the use of the IRF pattern actually hinders students in developing meaning as it restricts their thoughts to short, precise answers to teacher questions. A different view is that triadic dialogue, if used correctly, can not only be a good basis for developing meaning but can also provide an effective means for correcting, paraphrasing and refining students' utterances. (compare section 2.4) Interestingly, the IRF structures from this study seem to confirm both claims: While there are some initiations which allowed for only very limited number of expected answers (compare transcript 4.4.1 - students were expected to name two objects showed to them, a torch and a battery), there are also instances of questions which encourage thought and allow for a virtually unlimited range of possible answers (compare transcript 4.4.2 - students were asked what the difference between a battery and a torch is). These two examples nicely illustrate how the choice of question can open up or constrain the student's space for meaning making, and how the possible responses greatly depend on the I-move. Taking these two examples as extreme cases marking the boundaries of a continuum of possible questions it becomes clear that whether triadic dialogue is restrictive and limiting or a fruitful basis for meaning making, depends solely on the question asked.

This is not to say that questions allowing only for a limited range of answers should be avoided at all costs - such questions can be justified and useful, depending on the context and the goal they serve. Short questions aiming at eliciting an expected answer can, for instance, serve as a good means for keeping student's attention up during longer stretches of teacher lectures or dictations, where student talk time and involvement are at their lowest. In addition, such questions can also serve to quickly revise important terminology or concepts, thereby refreshing the learners' memory.

When carried out well, triadic dialogue can enable the teacher to not only have the learners ask themselves the right questions but also to guide, correct and repair their answers. In the best of cases, the teacher can manage to enable true Negotiation of Meaning to be carried out, and meaning to be developed. It is true that this form of interaction is unnatural and artificial in nature, but the data seems to suggest that it is this artificial form of communication which fosters the emergence of genuine NoM, which, in turn, is a very natural form of human interaction.

All in all, triadic dialogue is too broad a concept as to make general claims about its usefulness for meaning making. Rather, teachers should see it as a tool, the effectiveness of which depends -like with any other tool- solely on the way it is put to use. In addition, the intended outcomes depend greatly on the teaching context - it does not make much sense to strive at meaning making in assessment phases, for instance.

5.3.2 Language & student talk time

It has been shown that certain teaching contexts, above all revision phases and interactive teaching formats, seem to provide more opportunity for student output than others, which is favourable for a number of reasons. Firstly, it has already been discussed that being able, or required, to produce output will greatly benefit the student's language learning progress as it enables them to practice newly acquired structures and train otherwise neglected skills. Secondly, if students are actively involved they are, as has been shown, much more likely to engage in NoM and even to initiate them should the need arise.

On the other hand, certain contexts are highly un-interactive and mostly dominated clearly by the teacher, leaving little room for the pupils to participate actively in class. The most striking example for such contexts are dictations, which had the least student talk time. This is not to say that dictations should be avoided at all costs, but rather that teachers should be aware of such issues in deciding which teaching format to use.

Concerning language use, it is interesting to see how much influence the teacher actually has on student language. Consequent use of English by the teacher is most likely to make the students use English consequently as well. On the other hand, students will almost always immediately fall back to German should the teacher switch to German. Even greater seems to be the influence native speakers have on which language is used by the learners. Native speakers, regardless whether they are the class teacher or an assistant, are almost never addressed in German, which seems reasonable, given the fact that most pupils are unsure whether they speak German at all.

Nevertheless, even if these are obviously ways to facilitate the, one might even say exclusive, use of English in CLIL classes, it remains arguable if this actually is favourable. To begin with, it has been discussed in section 2.5.1 that code switching is an effective support strategy to aid comprehensibility not only for weaker learners. Secondly, as has also been discussed, the learners need to be familiarised with technical terms and their respective use in their L1 as well. All in all, even if it seems possible for CLIL teachers to facilitate, or even

enforce, exclusively monolingual lessons, they should rather strive to arrive at a functional use of the students L1 in CLIL classes.

5.4 IPN Data

The most interesting insight of comparing the two studies probably is the fact that the lessons of both studies are, on the average, quite similar in terms of structure and focus. There is only little difference in the ratios of teacher centred activities to student work phases, suggesting that there is a certain structure favoured by physics teachers. The same is true for the distribution of lesson phases, save the sole exception of the summarising phase, which was much more frequent in the IPN data. Again, there seems to be a distribution of priorities and lesson elements which physics teachers intuitively consider as sensible.

On the other hand, it is surprising to find no great differences in teaching style - at least with respect to lesson design and structuring - between regular physics teaching and CLIL instruction. One would assume that the inherently different demands also call for different priorities in the organisation of lesson time, for instance by providing additional time for revising or summarising. Concerning the latter point, the opposite is actually the case, with considerably less time being spent on summarising in the CLIL classes.

The many parallels found also point towards the fact that CLIL teachers receive no special training and thus spend only little time catering for the special requirements of CLIL instruction. Instead, the CLIL lessons are designed surprisingly similar to regular physics lessons. But, as has been established, there are a number of limitations which make a comparison like this somewhat inaccurate, and, more importantly, as so many other, but not less important, aspects of actual classroom practice cannot be taken into consideration, it is difficult to validate a claim like this from a mere comparison of the distributions of lesson time alone.

6 Conclusion

6.1 Conclusions

The most striking, and also troubling, insight gained from this case study is that while there were highly motivated, dedicated and competent teachers involved in the CLIL classes observed, there is obviously a lack of what I would like to call "CLIL-culture". None of the teachers enjoyed special training in the area of CLIL instruction, and therefore they were not aware of many of the guidelines, recommendations or any theoretical background that exist. As a consequence, so it seemed, instead of delivering good CLIL instruction, they put great effort into delivering great Physics classes in English, thereby neglecting much of CLIL's potential and additional challenges apart from the use of a foreign language. Sadly, the interviews, the data from the lessons and also my own experience all point towards that Austrian CLIL culture fails to go well beyond merely teaching science classes in a foreign language.

This is not to say that the classes observed were of poor quality or that the pupils involved were unlikely to benefit from the teaching, actually I would like to stress again that the opposite was the case, as has been already mentioned in section 4.3. Once again, the lessons observed were professional, and without doubt valuable, Physics lessons delivered in mostly equally professional English, but I believe that in most cases content and language failed to become more than the mere sum of its parts.

I believe the main reason for this to be the before-mentioned lack of "CLIL-culture". As has been said, there is a considerable lack of (compulsory) training on offer on the subject, Austrian policymakers have yet to apply formal requirements for teaching CLIL and schools as well as teachers receive little support for their CLIL projects.

If we, however, want to factor in many of the finer facets and characteristics of, and requirements for, CLIL instruction into our teaching, we need not only to observe a set of guidelines and recommendations but we also need to recognise that interactive and communicative processes and structures might play a much greater role than one would expect. After all, subject and language learning are (or should be) integrated in CLIL instruction, therefore communication cannot but play a decisive role: We have seen how the different use of I and F moves in triadic dialogue can make the difference between artificially restricting and actively opening the pupils' conceptual space, how the skilled use of Negotiation of Meaning can help learners overcome comprehension problems and cope better

with the challenge of a foreign language, how this perfectly natural form of human interaction can be explicitly stimulated in teaching situations to the benefit of the students and how the choice of interaction format influences the way the pupils along with the teacher jointly shape and create meaning. We must conclude then that teachers but also teacher educators cannot afford to neglect the role -and power- of communication and interaction in all types of communicative instruction, but especially in CLIL.

6.2 Implications for practice

I believe it has become clear that the CLIL instruction analysed, besides being professional and of high quality, failed to pay attention to some of the less apparent issues of the concept. This is especially true for the way language is learnt in CLIL classes and the often proclaimed intercultural aspects. This, I am led to believe, is mostly due to a lack of specific CLIL training for respective, but also in-service teachers. Maybe it is time to recognise that the policy of not setting any formal requirements for teaching in a CLIL setting might actually be counter-productive. The quality of CLIL instruction in Austrian schools can only benefit from requiring prospective CLIL teachers to undergo some sort of compulsory training, which could familiarise them with all of these aspects that are currently being neglected. Such a training does not necessarily have to be highly complex and time consuming, on the contrary, I believe that the basic principles could be communicated easily in a few-hours course. Considering the wide spread of CLIL programmes, such an approach seems not only reasonable, but also well worth the effort.

While prospective CLIL teachers should be familiarised with the basic principles and ideas behind CLIL, more experienced ones could, to my mind, benefit greatly from additional insights to the complexity of communicative and interactive processes in classrooms, especially CLIL classes. It has become clear, that the role of communicative structures is more than significant for educational contexts, and that NoM might even be of central importance to the success of CLIL, hence it is only logical to assume that CLIL teachers sensitive to these issues and in possession of profound knowledge of the matter will most likely craft and deliver even more effective lessons.

Apart from these implications, I would like to deduct a few additional recommendations and guidelines for effective CLIL practice from the analysis of the recorded lessons and the interviews against the background of the literature reviewed:

- *Lessons should be planned carefully and from a long-term perspective to include ample time for dedicated and explicit summary and revision phases, possibly without any assessment character.*
- *In such summary and revision phases, the teacher should strive at creating an environment for NoM to arise easily and naturally, for instance by*
 - avoiding any assessment character
 - consciously using paraphrased ideas
 - having pupils repeat or complete a line of thought and if necessary use scaffolding or similar techniques in order to repair incorrect or inaccurate expressions
 - avoiding any form of dictation (including copying from blackboard or any kind of slides) in summary or revision phases
 - not being hesitant to switch back to L1 if necessary
- *Teachers should consciously include activities or even whole lessons dedicated to language work in a Physics context. Ideas for such activities could be any of the following:*
 - Work with genuine texts (lab reports, publications) aimed at discovering certain grammatical structures, lexis or different language functions (formality, emphasis etc.)
 - Discussing useful idiomatic expressions for a given context (e.g. language for describing graphs)
 - Role plays with a communicative and scientific focus (eg. physicist talking to non-physicist about the likelihood of the Earth being consumed by a black hole)
 - Work on presentation skills by presenting an experiment or its results
- *The same is true for lessons aimed at improving intercultural competence, such lessons could include:*
 - Discussing culture- typical genre conventions or stances towards science, preferably of a culture where the target language is spoken primarily.
 - Discussing the contrast but also highlighting the similarities between "Western" science and indigenous science
- *When engaging in triadic dialogue, teachers should carefully formulate questions in their I-moves according to the aim they they are trying to achieve:*
 - For summary or revision, more restrictive questions are likely to elicit the desired responses, but are less likely to facilitate Negotiations. Finding the right balance is crucial to the effectiveness of teaching.

- For developing new concepts, too broad questions are likely to confuse the pupils or result in random guessing, too narrow ones will, again, not allow NoM to emerge. A possible alternative might be postponing triadic dialogue to a time after some rapport has been established, and the learners have some sense of meaning which can be negotiated.
- For challenging preconceptions, however, triadic dialogue seems a rather good starting activity, as there already is already some sense of meaning in the learners which they might consider correct or even shared.
- *In like manner, teachers should not underestimate the power of the F-move:*
 - Teachers should avoid mere correction, but instead use scaffolding or similar techniques to repair and eventually arrive at the correct, or accurate, meaning.
 - Challenging even correct responses by students can be used to check for thorough understanding and to initiate NoM.

It is important to note that, although being based on the observed classroom practice, statistical data and on reviewed expert literature, all of these implications remain hypothetical, or at best normative, as the amount of data collected and analysed is plainly too small to provide a basis for empirical proof.

6.3 Limitations and further research

This study, being a small-scale case study can of course not claim results significant enough to be treated as empirical evidence. Nevertheless, I believe that the insights gained are still highly interesting and valuable for CLIL practitioners. While not producing empirical results, the study provided examples of actual CLIL instruction in the field, which I believe to be typical to Austrian CLIL practice. Additionally, a number of recommendations and implications for practice was deducted from the data and the literature reviewed, whether these recommendations would have an actual impact on learning outcomes or benefit CLIL instruction in some other way, however, remains to be tested.

Furthermore, not only the small sample holds limitations but also the method itself. Some of the variables are necessarily subject to some interpretation, and applying a time-sampling method means that inaccuracies in intervals containing overlap or hard to distinguish situations cannot be avoided, therefore, and as with any measuring instrument, the collected data is not completely accurate. Nevertheless, it can be said with certainty that the most substantial of results (NoM are, for instance, twice as likely to appear in Summary than in New Content phases and almost ten times as likely to appear in Interactive than in Dictation formats) are based on significant data which is far beyond any possible error.

Future research could focus on closely analysing NoM in CLIL contexts, preferably including some sort of instrument to gauge positive effects such as better learning outcomes or an increase in student motivation. I would find it fascinating to learn whether there is indeed a statistically significant positive correlation to be found between the quantity and quality of NoMs and improvements in learning outcomes to be found, and especially, what role the use of a foreign language plays in that context.

6.4 Final remarks

Despite its limitations, I am convinced that this study and the implications deduced from its analysis can be a valuable contribution to improving CLIL practice in Austrian schools. Many of the issues it raised should be, along with many others, communicated to prospective CLIL teachers in order to sensitise them to some of the more subtle facets of CLIL instruction. Genuine Content and Language Integrated Learning should strive at a true *integration* of content and language aspects, so that not only content is learned through language, but language is also learned through content. In this light, CLIL must be seen as a highly complex means of instruction, necessarily combining issues from numerous scholarly fields, such as language acquisition, subject specific didactics, discourse analysis, general pedagogy and many more. Hence, CLIL unavoidably poses a great challenge to instructors and learners alike, but at the same time holds great potential for being an extraordinary form of instruction which challenges, motivates, and inspires students and produces learning outcomes that will last well beyond compulsory education.

7 References

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Anhang

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