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WebQuests in Content and Language Integrated Learning Classes on Primary Level

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In a research project on Information and Communication Technology usage in bilingual settings, pupils were observed by video recording while working with a bilingual PrimarWebQuest. The main research project focuses on the mathematical knowledge as well as linguistic aspects which pupils might acquire in CLIL-settings while using PrimarWebQuests. In this paper the pilot study is presented which focused on the interactions in such learning settings. It will be explained what Content and Language Integrated Learning (CLIL) means in a European context and to which components attention should be paid while planning the use of PrimarWebQuests in CLIL lessons. The fitting of CLIL and PrimarWebQuests will be described to outline the potentials of this approach. Its basic idea and its implementation in bilingual settings will be defined. Afterwards, the framework of the pilot study and first results will be described to conclude next steps of the main study.

Keywords: Bilingual education, primary schools, inquiry-oriented, web-based, time telling.

Research Aim

The advancing language competence of bilingually taught pupils has been proven, for example by Bechler (2014) or Kersten et al. (2010) and is caused by the higher frequency of language contact. In addition to *Basic Interpersonal Communication Skills* being in the front of traditional foreign language classes, bilingual classes deal with a *Cognitive/ Academic Language Proficiency* (Cummins, 1979). In a Canadian research project Bournot-Trites and Reeder (2001) could show that there are positive effects on mathematical learning when students are taught in two languages. Schubnel (2009), who investigated German-French speaking bilingual mathematics classes, suspects the additional linguistic access, which the pupils receive, as a reason for this phenomenon. Moschkovich (2002) describes a multiple-meanings perspective as one of three perspectives for describing bilingual students learning mathematics which seems to underline Schubnel's theory. The multiple-meanings perspective expands the complex role of language for learning mathematics as it highlights the idea of pupils developing and negotiating meanings of mathematical terms in bilingual settings.

As the pupils' everyday use of ICT, specifically the Internet, offers various possibilities to experience foreign areas, the research project investigates the combination of ICT and CLIL. Using ICT allows access to multilingual sources, which enables the pupils to work with authentic and multi-media material, including linguistic reality (Schmidt, 2013). The aim of the research project is to find out about the contribution of the PrimarWebQuest approach regarding the pupils' learning of a mathematical topic as well as the academic expressions which go with each topic. But for this pilot study the main goal was to describe and analyze the interactions between pupils, teachers and the material in a bilingual and digital learning setting for exploring the chances for CLIL lessons offered by PrimarWebQuests.

Bilingual Learning

Bilingual teaching and learning in Germany refer to educational situations in which a subject or even just a selected topic is taught in a different language for a fixed or an enduring time. The term *Content and Language Integrated Learning (CLIL)* is used as a generic term for bilingual learning models in Europe which can be implemented in different ways. It is the core philosophy of the European Union that each citizen of the EU should be able to functionally use at least two more European languages in addition to their mother tongue. This approach aims to connect content learning and language learning in an integrated way. It is seen as an effective method for learning a foreign language with the aid of authentic topics. The language abilities of bilingually taught pupils go beyond everyday speech, the so called *Basic Interpersonal Communication Skills (BICS)*. In bilingual classes pupils should acquire a more technical terminology, the so called *Cognitive/ Academic Language Proficiency (CALP)* which is necessary for demanding topics (Cummins, 1979).

Most studies about CLIL have been conducted at the secondary level. First results about CLIL at primary schools have been published (Elsner & Keßler, 2013). In Germany, the idea of CLIL-classes in mathematics has not been greatly accepted (Viebrock, 2013). There are only a few conceptual ideas in secondary schools as well as at primary level. There are even fewer teaching materials why it is necessary to fill this gap. One possibility for having access to more material seems to be the Internet.

In this pilot study, Coyles (2006) *4Cs Framework* was used for creating PrimarWebQuests for CLIL classes. In her framework she describes the four components *Content*, *Communication*, *Cognition* and *Culture* for planning CLIL lessons (see Figure 1). The *Content* of bilingual classes should be geared toward curricular guidelines of the subject, in this case Mathematics. The aim is a double and profound knowledge acquisition as well as the pupils' understanding with regard to the content. In Germany, the pupils' subject-based knowledge is defined by a curriculum. It describes mathematical skills and specific content areas pupils are supposed to achieve. In this study the pupils should deepen and expand their knowledge about times. *Communication* refers to extending pupils' language knowledge and abilities to qualify them for an academic interaction in class, like using the right expressions for talking about different parts of a day during mathematics classes. The component *Cognition* contains all cognitive abilities which can be established, such as strategy learning or metalinguistic knowledge which could be developed in discussions about different time telling expressions or during calculating activities of different time spans. Particularly in bilingual settings, pupils have to develop a reflexive attitude vis-à-vis their own and other *Cultures*. For behaving in an empathic way, it is important to think about various perspectives, opinions or feelings and to switch between them. The cultural component of the framework is touched by the task to help two people from another country by comparing German and English times for describing the differences to them.

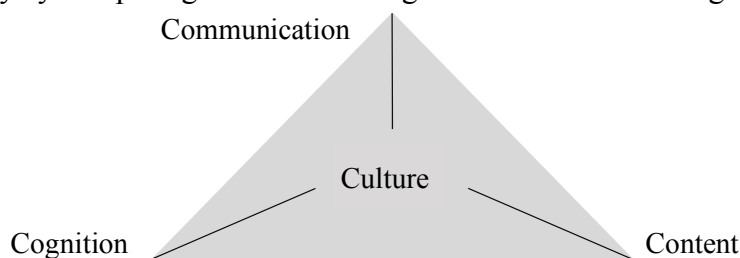
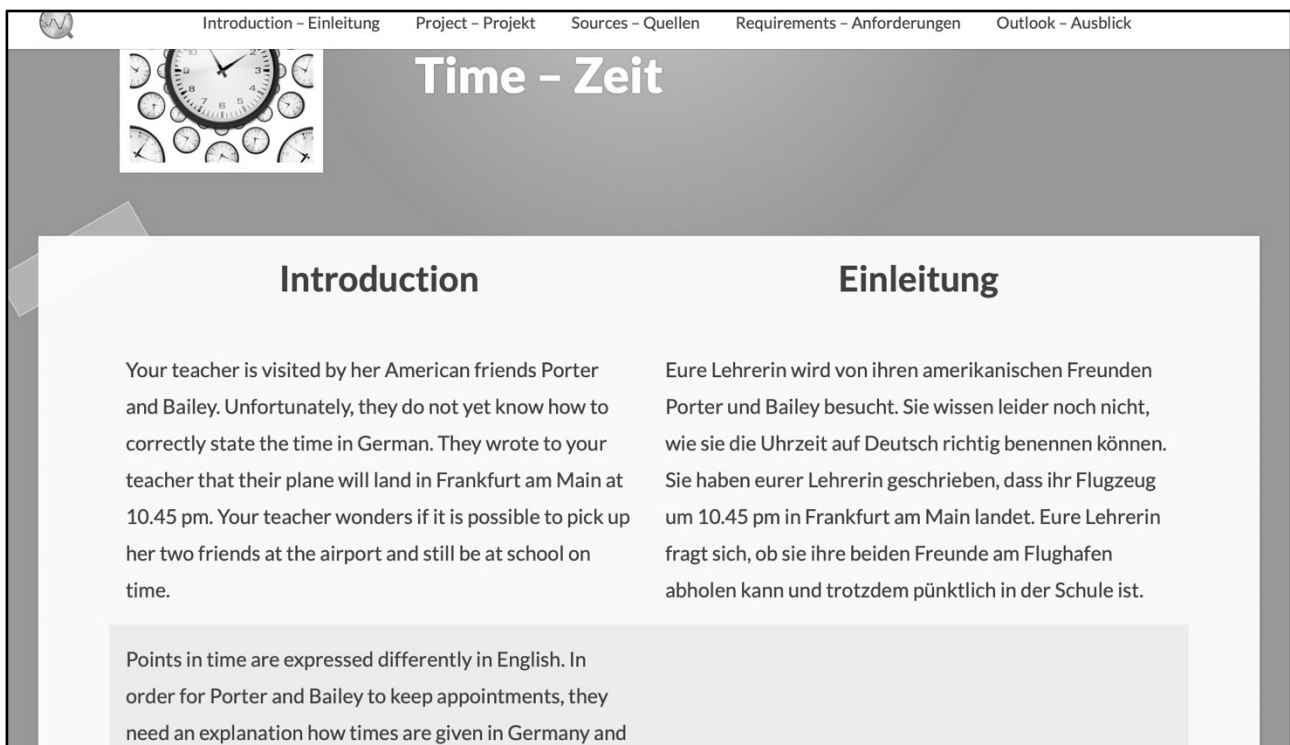


Figure 1: Curricular Framework for CLIL Classes according to Coyle (2006, p. 10)

PrimarWebQuests in Bilingual Classes

The method WebQuest, invented by Dodge and March in 1995, is an inquiry-oriented and web-based learning approach for using internet sources (Dodge, 1997). Even though it is offered on the Internet, the pupils can use online as well as offline sources which have to be chosen by the teacher in advance. WebQuests should give a structure for using the internet sources in an efficient and target-oriented way (Baschek & Schreiber, 2020). Schreiber adapted the method for primary school children in Germany. He called it *PrimarWebQuest*. A PrimarWebQuest contains various sources in order to deal with mathematical concepts and issues. It can set a focus on important aspects and reduce the complexity of available information which can be found on the Internet. The pupils learn in small groups how to conduct their research with online resources themselves (Baschek & Schreiber, 2020). Media competences like searching for, selecting and using online information as well as cooperating, presenting and reflecting can be trained with the small version of the original World Wide Web which is designed by a PrimarWebQuest. The requirements of a PrimarWebQuest should be made transparent for the pupils before beginning. They must be able to self-evaluate their learning process and the learning product (Schreiber & Kromm, 2020).



The screenshot shows a web page with a navigation bar at the top containing the following links: Introduction – Einleitung, Project – Projekt, Sources – Quellen, Requirements – Anforderungen, and Outlook – Ausblick. The main heading is 'Time - Zeit', accompanied by an image of several analog clocks. Below the heading, there are two columns of text. The left column is titled 'Introduction' and the right column is titled 'Einleitung'. At the bottom, there is a grey box containing a note about time expressions in English and German.

Introduction	Einleitung
Your teacher is visited by her American friends Porter and Bailey. Unfortunately, they do not yet know how to correctly state the time in German. They wrote to your teacher that their plane will land in Frankfurt am Main at 10.45 pm. Your teacher wonders if it is possible to pick up her two friends at the airport and still be at school on time.	Eure Lehrerin wird von ihren amerikanischen Freunden Porter und Bailey besucht. Sie wissen leider noch nicht, wie sie die Uhrzeit auf Deutsch richtig benennen können. Sie haben eurer Lehrerin geschrieben, dass ihr Flugzeug um 10.45 pm in Frankfurt am Main landet. Eure Lehrerin fragt sich, ob sie ihre beiden Freunde am Flughafen abholen kann und trotzdem pünktlich in der Schule ist.

Points in time are expressed differently in English. In order for Porter and Bailey to keep appointments, they need an explanation how times are given in Germany and

Figure 2: Part of the introduction of the bilingual PrimarWebQuest with the topic of times

Before starting their work, the pupils are split into small groups and get an introduction for using PrimarWebQuests. In the following sequence, the pupils look for more detailed information of their topic independently in their small groups. The teacher only supports them when she or he is asked to do so by the pupils. After the first working phases, there is a sequence for reflecting the working process up to this point. This sequence also offers the possibility to talk about crucial mathematical aspects. The pupils start to prepare their solution for the task and present their results at the end of the unit. When all presentations are done, the teacher reflects with everyone about their group work.

Generally, bilingual PrimarWebQuests (German/English) and monolingual German ones follow the same structure. On the web pages of bilingual PrimarWebQuests, pupils can read all information and instruction in both languages, despite the chosen sources. Because of two different language columns, they can choose the working language independently in every group. When opening one of the sites, the pupils only see the English text in the beginning. By clicking on an English paragraph, the German translation appears (see Figure 2). There are sources in both languages as well, so every group, regardless of which working language they choose, has the possibility to use both languages for research. The sources are mostly realistic web pages made by native speakers (Baschek & Schreiber, 2020). Bilingually designed PrimarWebQuests can motivate the pupils to switch between the languages. When the pupils are motivated to do so by the PrimarWebQuest or the teacher, they practice to work language-sensitively while switching. Additionally, the pupils can get into a collaborative dialogue because of the open-ended nature of the task. Discussing new terms with their classmates offers them the possibility to check their understanding of mathematical terms. Nevertheless, an adaption to the pupils' linguistic knowledge is necessary for a beneficial use of bilingual PrimarWebQuests and to ensure a successful learning experience for all (Baschek, 2020).

Pilot Study

The pilot study was undertaken for describing interactions in a bilingual and digital learning setting to discover chances for CLIL lessons offered by PrimarWebQuests. The group activities were video and audio recorded. Transcripts are and will be generated out of crucial sequences of the collected data, such as discussions about mathematical facts or language-sensitive activities, and will provide the foundation for the processes of analysis and interpretation. By using the interaction analysis (Krummheuer, 2002), the way, in which individuals create and negotiate taken-as-shared meaning, is reconstructed. The aim is to reconstruct any interactions in situations that are meaningful for the participants and to construct as many interpretations of these actions as possible. Every utterance is closely examined and analyzed in small groups for providing multiperspectivity. The utterances need to be kept in chronological order. Interpretations can only be justified and linked backwards as they can only be based on utterances made previously. These initial interpretations are then reinforced or rejected in order to ensure the most convincing interpretation of the episode.

A bilingual PrimarWebQuests¹ about *time telling* was tested with six third graders of a German private primary school offering bilingual classes (German/English) in multiple subjects. Mathematics is taught part-time in English and in German. The school follows the German curriculum and uses German and Irish textbooks. Most of the participants' mother tongue is German, one participant was raised bilingual. As not all pupils of the class were involved, the six participating pupils worked in two groups of three while their classmates did the regular tasks in their classroom. The two groups worked in one room at the same time and were supported by an English-speaking as well as a German-speaking teacher which were the researcher and an assistant. The pupils did not know this method before but were asked to use the bilingual PrimarWebQuest while the working language was chosen freely by them. The explanation for Porter and Bailey, who need the pupils' help for arrival and

¹ The bilingual PrimarWebQuest can be found here: <https://math-primwq-bilingual.sd.uni-frankfurt.de>

departure times in the PrimarWebQuest, had to be in English (see Figure 2). As the topic of time telling is dealt with mainly in second grade of German schools, on the one hand, this PrimarWebQuest should activate the previous knowledge of the pupils for deepening it. For instance, the difference of points in time and time spans turns calculating into a complex activity which needs to be practiced multiple times. Additionally, fractions, which are no topic of German primary schools, are used for time telling expressions. Instead of only learning the right expressions by heart, the pupils need enough time to think and talk about their conceptual meaning of those expressions for developing an understanding of fractions. On the other hand, using the shown task indented the pupils to learn the differences of time telling in the languages as an intercultural aspect. For example, using am and pm does not only mean to learn the right vocabulary. It also needs the pupils to think about the different time spans of every day and how times can be located in those parts of a day as this phenomenon does not exist in German time telling.

The different sequences of PrimarWebQuest usage offer several possibilities for supporting the mathematical language skills of bilingually taught pupils. To highlight possible learning opportunities of a PrimarWebQuest, pupil interactions are described and analyzed. During a group working sequence, the pupils discuss English and German vocabulary they will need for talking about different points of time. In the following example, the pupils know a German term and try to find the English translation together. Originally English utterances are typed in SMALL CAPITALS, whereas originally German utterances are typed in normal style. Gestures, activities and additional information are typed in *italics*.

Person	Translated utterance
Teacher:	OKAY. THE NEXT WORD IS THE BACKGROUND OF THE CLOCK WHICH IS WHITE. DO YOU KNOW HOW IT IS CALLED? IN GERMAN OR IN ENGLISH? GIOVANNA.
Giovanna:	Ziffernblatt?
Teacher:	Ziffernblatt IS THE GERMAN WORD. RIGHT (<i>attaches the word card to the black board</i>). AND DO YOU KNOW THE TRANSLATION MAYBE? LUKAS.
Lukas:	NUMBER PAPER.
Teacher:	NO IT'S NOT THE DIRECT TRANSLATION. LAURA?
Laura:	FACE.
Teacher:	FACE IS RIGHT AND ONE WORD IS MISSING. LUKAS?
Lukas:	NUMBER FACE?
Teacher:	NOO.
Laura:	(<i>puts her hand in front of her face and whispers</i>) HAND FACE.
Teacher:	NO IT'S NOT A HAND FACE. WHOSE FACE IS IT (<i>points at the clock which is attached to the black board</i>)? LAURA?
Laura:	EH NUMBER NO EH CLOCK FACE?
Teacher:	(<i>nods</i>) CLOCK FACE. RIGHT. WELL DONE (<i>attaches the word card to the black board</i>).

In this sequence it is possible to see how the pupils use both languages. Knowing the German term and supported by the teacher, they try to figure out the English translation. Lukas who was raised bilingual starts with an almost direct translation of the German term. Laura remembers *face* as a part of the translation. She could have gotten this information from the informational texts of the PrimarWebQuest. Listening to the teacher's hint, Lukas tries to build a word with *number* again and puts the two words together, calling it *number face*. The discourse seems to motivate him to use his metalinguistic knowledge. Laura instead thinks of further vocabulary by using the term *hand face*

which probably refers to the hour and the minute hand and can be an expression she learned from the informational texts. Supported by the teacher, Laura finds the right translation *clock face*. As the specific terms of this topic are similar to everyday language, the main goal for the pupils to learn is using the right expressions. All pupils show a proper use of the terminology in both languages. In fact, they speak more German than English, but they think of the English expressions when writing down notes for their explanations. During the working sequences, the pupils read and interpret the given authentic sources and they need to gather and check suitable information details. It was possible to observe a subject-based discourse in both groups motivated by the *PrimarWebQuest*. Specifically, the pupils discussed a lot about the difference between am and pm because they developed an idea which parts of the day are addressed.

The following sequence shows how the pupils work together and discuss in a group spurred on by the *PrimarWebQuest*. They are divided over pm being the morning or the evening of a day and try to find an answer together. For solving their problem, they think of the information which the given texts contain and use a graphic which they copied from a text. The group work helps them to communicate successfully about new information and to get to a mutual solution.

Person	Translated utterance
Teacher:	YOU ALSO READ THE INFORMATION ABOUT AM AND PM, SO YOU CAN THINK ABOUT IT. WHETHER IT IS IN THE MORNING OR THE EVENING.
Julia:	IT'S IN THE EVENING. EH MORNING.
Laura:	So that means... Where is this piece of paper (<i>unintelligible</i>) it is here.
Julia:	Why was it there?
Laura:	We are, so PM IS IN THE MORNING (<i>points at the afternoon of a plan of a day with its times</i>).
Julia:	No, PM IS EVENING.
Laura:	I see, right.
Julia:	IT'S IN THE EVENING.
Laura:	IT'S IN THE EVENING.
Teacher:	RIGHT.
Julia:	What is two o'clock in the evening?
Laura:	They could, she can come to school.
Eva:	Two o'clock is in the morning.
Julia:	Two o'clock can also be in the evening. Namely after one. At one o'clock you eat and at two...
Laura:	But it is PM.
Julia:	Two o'clock is fourteen o'clock.
Eva:	Yes.
Laura:	Yes, but it also can be PM. It is PM anyway.
Julia:	It says PM, so it is fourteen o'clock.
Laura:	Noo, PM is in the evening (<i>uses the wrong German article</i>).
Julia:	Yes, therefore fourteen o'clock.
Laura:	(<i>hits her head with her hands</i>)
Julia:	But it says, noo, fourteen.
Laura:	Yes okay, do what you want.
Julia:	Yes have a look Laura. Two o'clock is fourteen o'clock.
Laura:	Yes I understood that. Yes I understood that.

In the beginning, the three girls think that a pm time belongs to the mornings. The teacher needs to suggest to check their assumption. During the conversation with the teacher a change from one language to another can be observed. After the switch Julia does when the teacher comes to help the

group, a multiple switching between the two languages can be observed. This shows that the pupils use their languages in a flexible way and adapted to their communicative intention as well as the task of the PrimarWebQuest. Set off by the group work, they need to describe their own thinking processes while comparing their assumptions and they can learn to verbalize their understanding of the informational texts on their own. In this sequence two different opinions can be observed, but the girls don't seem to be able to explain their assumptions. By naming examples, Julia tries to convince Laura and Eva. Working together, they seem to find out that 2 o'clock pm means 14 o'clock. The open-ended task of the PrimarWebQuest supports their subject-based discourse while preparing the explanation for Porter and Bailey because the pupils need to come to a mutual result.

Conclusion

To begin with, the pupils seem to feel safe because of the open choice of working language. They use the English language when talking to the English-speaking teacher or when preparing their explanation for Porter and Bailey. Therefore, the setting motivates the pupils to work with both languages in an authentic way. In retrospect, it can be considered the pupils learned some new vocabulary or rather time telling expressions and could deepen their existing knowledge. Both groups had the opportunity to improve their strategies in mediation, as most of their discussions are German and their explanation for Porter and Bailey has to be in English. Especially in the working sessions with both groups, most of the pupils showed advanced metalinguistic skills (*Cognition*).

The open-ended task allows an individual main focus during the working sequences. If the content of the sources is too complex for the pupils, the PrimarWebQuest can purposefully guide their work on the task by helping them structure their working steps. Specifically, the intercultural topic of using am and pm encourages them to think about the informational texts and to use their copied graphics (*Culture*). This unknown content motivates the pupils to negotiate new terms or knowledge with their working groups for developing new concepts (*Content*). This cooperation can support language learning as well as a proper language use. Additionally, the pupils seem to be able to communicate adequately to mathematics classes as they can explain their calculating of times and use expressions which contain fractions easily (*Communication*). Besides the language and mathematical learning, the pupils also worked on their media competences while multiple internet sources.

To conclude, using the method PrimarWebQuest can be advantageous for CLIL in mathematics classes. For many topics there is not enough material for CLIL lessons in mathematics. The Internet and its diversity can be a support. The method enables dialogues, offering the possibility to investigate the pupils' understanding of mathematical terms either for teachers or for researchers.

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