Differentiation in CLIL Mathematics in the First and Second Grade

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Master's thesis
Autumn term 2020
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Tiihonen, Nina. 2020. Differentiation in CLIL mathematics in the first and second grade. Pro Gradu. University of Jyväskylä. Department of Teacher Education. 81 pages.

The goal of this study was to create an understanding of how Content and Language Integrated Learning (CLIL) mathematics is implemented and how differentiation can be used in a young learners' CLIL mathematics classroom. The aim was to find possibilities for differentiation in the math education and CLIL classrooms since it is one of key features of supporting learners. Differentiation is a support tool for education based on educational theories like Vygotsky's Zone of Proximal Development.

This study was created from the bases of the 5D model created by Roiha and Polso (2018,2020) and the participants (=2) were observed through video recordings and interviewed. The data was analysed using qualitative content analysis methods and are presented in sections based on the 5D model; teaching arrangements, learning environment, teaching methods, support materials and assessment.

This research showed that teachers tend to use CLIL as a form of differentiation for regular mathematics lessons. Teachers claimed that they do not differentiate their CLIL mathematics sessions when in fact they used versatile means of differentiation. The teaching arrangements are often not something the teachers can affect on but CLIL and differentiation are both pupil-centred teaching models and therefore beneficial for pupils. The teachers were happy with the resources and materials but there were no shared assessment methods for CLIL.

Teachers in this study seemed to underestimate the efforts they are making when in fact they are providing variety of differentiation for their pupils. The 5D model can help teachers to assess their own teaching and further develop their pedagogy.

Key words: Differentiation, Content and Language Integrated Learning, Language Enriched Education, Mathematics

Tiihonen, Nina. 2020. Eriyttäminen CLIL-matematiikassa ensimmäisellä ja toisella luokalla. Kasvatustieteen pro gradu-tutkielma. Jyväskylän yliopisto. Opettajankoulutuslaitos. 81 sivua.

Tutkimuksen tavoitteena oli selvittää miten sisältöä ja kieltä integroivaa (CLIL) opetusta toteutetaan ja eriytetään alkuopetuksessa. Tavoitteena oli löytää eriyttämisen mahdollisuuksia matematiikan CLIL-opetuksessa, sillä eriyttäminen on yksi keskeisiä oppijan tukemisen keinoja. Eriyttäminen on oppimisen tukityökalu, joka pohjautuu kasvatustieteellisiin teorioihin, kuten Vygotskyn lähikehityksen vyöhyke.

Tämä tutkimus pohjautuu Roihan ja Polson kehittämään 5D-malliin. Tutkittavia (n=2) videoituja oppitunteja observoitiin ja haastateltiin. Aineisto analysoitiin laadullisen sisällön tutkimuksen menetelmiä ja esitetään jaoteltuna 5D-mallin mukaisesti: opetuksen järjestelyt, oppimisympäristö, opetusmenetelmät, tukimateriaalit ja arviointi.

Tulokset osoittivat, että opettajat hyödyntävät CLIL-opetusta normaalin matematiikan opetuksen eriyttämiseen. Opettajat kertoivat, etteivät eriytä CLIL-matematiikan opetusta yhtä paljon kuin muuta opetusta, mutta itse asiassa he hyödyntävät eriyttämistä monipuolisesti. Opetusjärjestelyihin opettajat eivät voi itse usein vaikuttaa. CLIL-opetus ja eriyttäminen ovat oppilaskeskeisiä menetelmiä, jotka yhdessä hyödyttävät oppilaita. Opettajat kokivat materiaalit ja resurssit riittäviksi, mutta CLIL opetuksen arviointiin ei ollut jaettuja menetelmiä.

Tämän tutkimuksen opettajat vaikuttivat aliarvoivan käyttämiään eriyttämisen keinoja, vaikka todellisuudessa heillä oli käytössä monipuolisia menetelmiä. 5D-malli voi auttaa opettajia arvioimaan ja kehittämään omaa opetustaan.

Asiasanat: eriyttäminen, CLIL-opetus, kielirikasteinen opetus, matematiikan opetus

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Introduction

Finland has a world-renowned reputation as a successful educational system and PISA (Programme for International Student Assessment) results. Unfortunately, the trend in the past assessment rounds has been downward and the learning outcomes are not what they used to be (OECD 2003; 2010; 2013; 2016). To change the direction of this development the Finnish educational system needs to react and evaluate the ways our system could be improved, and more efficient learning could take place. Approximately 15-20% of Finnish children have some kind of learning difficulty in mathematics (Aunio & Räsänen 2015, in Mononen et al., 2017) and the most basic skills are developed during the first few years of

school. This means that a lot of support is required in developing these skills. Based on the PISA results it seems that the amount or quality of this support is not yet where it needs to be.

In the Finnish education system, every pupil has the right to good education that considers each pupil to be unique and valuable and every student has a right to sufficient support as the need arises (The Finnish National Core Curriculum for Basic Education, 2016, hereafter FNCCBE, 2016). The FNCCBE (2016) is based on a social constructivist view of learning where the pupil is seen as an active agent learning in interaction with peers and the teacher. Using all senses, different learning methods and environments is important, as well as learning-to-learn skills and pupils should be motivated and experience the joy of learning (FNCCBE, 2016). The Finnish Curriculum (FNCCBE, 2016) entitles all pupils to receive the support they need to reach the learning goals set for them and the curriculum also defines a threefold support system for doing so.

Differentiation is a collection of ways in which the teacher can support a pupil's learning process (Tomlinson, 2014). It is based on multiple educational theories, the most important ones being Vygotsky's (1935/19878) Zone of Proximal Development and Gardner's (1983, in Tomlinson & Allan, 2010) theory of Multiple Intelligences. The goal of differentiation is to support and vary the extent, depth and the progress rate of studying according to the pupils needs (FNCCBE, 2016;Tomlinson, 2014). Teacher's differentiation practices in content, assessment and co-teaching are not only affected by their own beliefs about differentiation (Roiha, 2014) but also by teacher's efficacy beliefs (Aunio, Ekstam, & Linnanmäki, 2017). Aunio et al. (2017) found no relation between the frequency of differentiation practices and teachers certification status nor experience. In conclusion it could be said that the teachers' theoretical knowledge, whether it is learned during training or after, of differentiation and how they see themselves as teachers has a significant effect on how they implement it in the classroom. The means for differentiation are again versatile from teacher to teacher and some teachers feel that there is not enough time or suitable material to differentiate as much as they would like to or they feel uncertain of the possible methods (Naukkarinen, 2005; Roiha, 2014). Teachers seem to need more guidance and concrete guidelines to help them develop their own methods.

CLIL education is a very pupil-centred learning-approach and the combination of both content and language goals creates pedagogical opportunities for implicit second

language acquisition (Krashen, 1985). The methods of implementing CLIL vary from teacher to teacher and there are not many schools providing systematic CLIL education in Finland (Kangasvieri, Miettinen, Palviainen, Saarinen, & Ala-Vähälä, 2012;Saarinen, Kangasvieri, & Miettinen, 2012; Peltoniemi et al., 2018). When both content and language learning are combined, the teaching needs to be clear and supported with visualisations or concrete examples (Coyle, Hood & Marsh, 2010). CLIL education is not mentioned as a term in the Finnish curriculum but it is included in the language enriched education section (FNCCBE, 2016) and therefore it does not have its own nationally set goals. Each school can develop their own curriculum for CLIL, or teacher can provide CLIL education independently.

Even though Finland has placed very high rankings in the mathematics performance in the PISA (Programme for International Student Assessment) during the past twenty years (OECD 2003; 2010; 2013; 2016), it estimated that 15-20% of children have some type of mathematical learning difficulties (Aunio & Räsänen 2015, in Mononen et al., 2017). Mononen et. al (2013) found that there are quite significant differences in the pupils' mathematical skills in the beginning of the first grade (n=175). The experiences pupils get from mathematics considering their selfesteem and motivation has a big effect in their skill development during the later school years (Aunola, Leskinen, Lerkkanen, & Nurmi, 2004). This research suggests that every teacher will have students with some types of problems in the classroom. Joutsenlahti (2005) found in his study that pupils did not find the learning of mathematical skills meaningful and therefore the learning was not very effective. He argued that the reason was too teacher and workbook-oriented teaching as pupils in a Finnish classroom are traditionally quietly working on their exercises independently.

I have studied to become a class teacher who is able to teach school subjects through English and therefore CLIL mathematics is a personal interest of mine. The idea for this research came to me whilst visiting a school providing CLIL education systematically from the first grade up. I observed the lessons and began to wonder how teacher support the learners when combining two things many pupils struggle with, foreign language and mathematics. The focus of this study is the implementation of CLIL mathematics and differentiation in a Finnish classroom. Firstly, the theoretical background of differentiation, basic mathematical skills and CLIL education are introduced. Secondly, the

theoretical framework is introduced. I have chosen to use Roiha and Polso's (2018;2020) innovative five-dimensional model of differentiation to also test if it can be used as an observational framework also for CLIL education. The third section will introduce the research process. The findings of this study are introduced in section four and the fifth section will discuss them in relation to the literature and previous research. This study is a part of the IKI-project[1].

[1] https://www.jyu.fi/edupsy/fi/tutkimus/hankkeet-projects/iki

1 LITERATURE REVIEW

1.1 Differentiation

Differentiation in the classroom means that pupils' individual needs and abilities are met to allow more efficient learning (Bender, 2008, 6; Tomlinson, Brimijoin, & Narvaez, 2008). Differentiation is not a specific pedagogical tool but rather a conclusion of several theories and can been seen very differently by each teacher (e.g. Naukkarinen 2005). Theories that are seen to be behind differentiation are Vygotsky's Zone of Proximal Development and Gardner's Theory of Multiple Intelligences (Tomlinson & Allan, 2000). Differentiation can be carried out in the extent, the depth and the progress rate of studying (Amendments and Additions to the National Core Curriculum for Basic Education, 2010; Tomlinson, 2014) but in practise the methods are very much dependent on individual teachers' knowledge and perception of differentiation (Roiha, 2014).

The Finnish National Core Curriculum for Basic Education (further FNCCBE,2016) grants rights for sufficient support for all pupils. The curriculum is based on the Constitution of Finland, the Basic Education Act, Government Decrees and number of international agreements (e.g. the Rights of the Child). Each pupil is seen as valuable as the other and the aim is for everyone to reach their own full potential (FNCCBE, 2016). The next sections will first introduce the theoretical background of differentiation in general and then move to describing how differentiation is presented in the Finnish curriculum. Lastly some challenges of differentiation are discussed.

1.1.1 Theoretical background

One very important theory behind differentiation is Lev Vygotsky's theory of the Zone of Proximal Development. Vygotsky is a key figure in sociocultural theorisations of human learning and studied the relationship between children's development and learning. He was critical towards the ways, for example, Piaget, Binet, James and Koffka described learning (Vygotsky, 1935/1978) rejecting Piaget's view of development as prerequisite for learning or James' view that development and learning coincide. Vygotsky also disagreed with Koffka who thought of development as an interactive combination of maturation and learning. Vygotsky himself saw learning and development as interrelated

processes where children always have some previous history with the topic of learning and development lagging behind (Vygotsky, 1935/1978).

Vygotsky (1935/1978) introduced a new concept, the zone of proximal development, as a way to understand the difference between preschool and school learning. The developmental cycles the child has completed compose the actual developmental level and can be tested on to reveal their mental abilities. These functions have already matured but he then thought about the functions that have not. He described the functions a child could do with assistance from a teacher or a peer as functions still in embryonic state. These will mature to functions that children can do independently and therefore prospectively describe their mental development. In this zone, the gap from independent to assisted functions, children can learn by imitating or guidance and school should offer these kinds of tasks to children. Their learning is effective when the tasks are more advanced than their actual developmental level and these higher mental functions will start to internalize raising the level of their actual development (Vygotsky, 1935/1978).

Drawing on Vygotsky's ZDP many researchers have developed their own concepts, one example being Mercer's Intermental Development Zone (2000/2008). Mercer claimed that ZDP is not a dynamic process and created his ow model to understand teaching and learning as an intermetal process (Mercer, 2008). In Mercer's model, the teacher and learner create a shared zone, described as a bubble, where they negotiate to complete task and maintain the bubble by dialogue (Mercer, 2008). Different ways that the teacher can support the learner in these tasks are referred to as scaffolding (Wood, Bruner & Ross, 1976, in Van De Craen, Surmont, Knell, Stroughmayer, & Struys, 2018).

Another interpretation of Vygotsky's theorizations has led to the notion of multiple intelligences (Gardner 1983, in Tomlinson & Allan, 2010). Gardner (1983, in Tomlinson & Allan, 2010) has described eight different forms of intelligence which are fluid and can be used within different situations. The eight different capacities are verbal-linguistic, logical-mathematical, visual-spatial, bodily-kinesthetics, musical-rhythmic, interpersonal, intrapersonal and naturalist. According to Gardner (1983, in Tomlinson & Allan, 2010) people have strengths and preferences in different intelligences and they utilize those in solving problems. While pupils can operate with multiple different ones, they would benefit from taking these into consideration in their schoolwork. At the moment the verbal-linguistic and logical-mathematical intelligences are emphasized in schools where

the focus of education is determined by the authorities according to which intelligences are valued by society (Gardner, 2011). Pupils have different strengths and there are a lot of pupils who struggle to reach the learning goals set in the curriculum and could benefit from getting support in the form of their preferred intelligence and being supported in task that require the use the other intelligences. Therefore, differentiation is such an essential part of teacher's pedagogy. The next section introduces the requirements for differentiation in Finnish education.

1.1.2 Differentiation in the curriculum

It is stated in the current curriculum (FNCCBE, 2016) that every student is entitled to get support as soon as a need appears. The needs are not specified in the curriculum, but examples could be a difficulty to understand instructions, difficulty with reaching the content learning goals or focusing. Every student is also entitled to receive good education, have feelings of success and learn to take responsibility for their own learning. The curriculum sees the student as an active agent and their interests, feelings and experiences should guide the learning process. These reflect the current understanding and research about good quality education. Student's self-esteem should be reinforced and positive, yet realistic feedback should be given (FNCCBE, 2016). A practical model for describing the amount and intensity of support is the threefold support system which is introduces in the next section.

Threefold support

The newest FNCCBE (2016) defines the stages of support that must be offered to all students. The stages are general support, intensified support and special needs support. In this method the aim is to support the students in the first two stages as much as possible to avoid the move into the third. The third stage can be considered to be a similar procedure as a move to special education has previously been (Roiha, 2012). The support should be offered for as long as needed and should be based on the individual needs of the student (FNCCBE, 2016, 103). Differentiation is a common practice on all of the stages, although often maybe considered to be only offered in the first stage (Roiha & Polso 2018a).

The first stage, general support, can be given to any one as soon as signs of need appear. It does not require any testing or official statements (FNCCBE, 2016). If the

amount of general support does not seem adequate the student moves to the second stage to enhanced support which is more planned and long term. These means of support are documented to the students' personal learning plan (FNCCBE, 2016). If the goals are still not met, the student can be moved onto the third stage to special-needs support. This decision requires a pedagogical statement and both the student, and their parent or legal guardian should be heard on the matter (FNCCBE, 2016).

The section 2.2 *The 5D model* introduces some conventional means of differentiation. If sufficient support is offered as general support to pupils, less pupils require more intensive forms of support (Ikonen et al. ,2012). There is little research on differentiation in this threefold support system in CLIL context, but it is seen as a part of all the different support levels. The next section will discuss the challenges in providing efficient differentiation are discussed.

1.1.3 Challenges in differentiation

Differentiation is an important part of teachers' everyday work, but teachers often feel that they do not do enough of it. Teachers use formative assessment to monitor their students daily to be able to modify their teaching to the needs of the students. An important part of differentiation is to involve the student, make them aware of their own achievements, learning skills and help them boost their motivation and self-efficacy (Tomlinson, 2014). These requirements can feel like a lot. Roiha (2012) asked CLIL teachers (n=41) in his research what they think are the main challenges for differentiation. 90% of them said that there is not enough time or resources. 71% said that there are not enough materials and 61% that the class sizes are too big for efficient differentiation.

Aro (2018) points out that instead of describing specific means, the curriculum focuses on describing the process of the threefold support system. This means that teachers are left with planning the means. This requires a lot of knowledge of learning difficulties and options for differentiation. Differentiation in a Finnish CLIL mathematics classroom has not really been studied and combined learning goals create new needs for differentiation. The next chapter will introduce the mathematical skills of the pupils in the first and second grade to help create a picture of the goals for mathematics in the lower grades.

1.2 Mathematical skills in the first and second grade

Finnish first graders have a lot of knowledge about mathematics even before starting school (Mononen, Aunio, Hotulainen, & Ketonen, 2013). This could be because majority of Finnish children attend preschool, a prerequisite for all children in Finland since 2015. The Finnish curriculum defines the content for the first and second grade very specifically and the first two years are very critical for the learning of the basic mathematical skills (Mononen, Aunio, Väisänen, Korhonen, & Tapola, 2017). Since the pupils are very young (7-8 years) a lot of the learning is gained through games, stories and other activities. The following sections will first introduce the basic mathematical skills developed during the first and second grade, the learning goals set in the Finnish curriculum and finally how mathematics is conventionally differentiated.

1.2.1 Development of basic mathematical skills

Aunio and Räsänen (2015, in Mononen et al., 2017) have outlined a theoretical framework of the development of mathematical skills with children under 8 years old. Aunio and Räsänen (2015 Mononen et al., 2017) propose that mathematical skills include four different sets of skills: *symbolic and non-symbolic number sense*, *counting skills*, *understanding mathematical relations* and *arithmetic skills*. Learning mathematical skills begins right after birth and these skills are a prerequisite to learning school mathematics.

Symbolic and non-symbolic number sense is an innate non-verbal ability to understand quantities and subitising. This is one of the biggest indicators of future mathematical skills (Aunio & Räsänen, 2015 in Mononen et al., 2017). Children learn to understand mathematical relations by comparing, classification and serialization (Aunio & Räsänen, 2015, in Mononen et al., 2017). When children develop more language skills, they start to chant number words as rhyme. Later they learn the connection of the word to the number of objects and the one-to-one correspondence which then makes counting possible (Aunio & Räsänen, 2015, in Mononen et. al., 2017). These number word sequence skills and enumeration skills lead to learning symbolic meanings of the numbers and this is one the main learning goals of early school mathematics (FNBECC, 2016). With these mathematical symbols children can start to learn arithmetic principles, place value and base-10 system. Usually in the beginning children use fingers or other objects to support these calculations (Koponen, Salminen & Sorvo, In Ahonen et al., 2019). When learning

basic arithmetical skills children first use objects and numerals and gradually move towards more abstract counting. Finally, children automatize basic arithmetical operations and the answers are in their memory (Aunio & Räsänen, 2015, in Mononen et al., 2017). Memorizing these basic arithmetical facts from the extent from one to 20 is usually happened at the age of 9. In school mathematics, children from ages 8 to 12, learn to operate with a larger range of numbers, rational numbers and how to use these skills to solve verbal problems.

Some mathematical skills (e.g., *symbolic and non-symbolic sense of numbers*) are non-verbal, but others are very connected to children's language skills (Aunio & Räsänen 2015, in Mononen et al., 2017). Some studies have found that phonological awareness and spatial attention is connected to counting skills and basic arithmetical skills (e.g. LeFevre et al. 2010 in Mononen et al., 2015; Simmons, Singleton & Horne, 2008). Often difficulties in learning appear in multiple areas so that same children may have problems with mathematical and literacy skills (Korhonen et al., In Mononen et al., 2017). Different languages like Finnish or English are considered natural languages whereas mathematics can be seen as its own language (Pimm, 1987). Being able to read the mathematics out loud requires learning this formal language of mathematics and it is not that different to learning any other language (Thompson, Kersaint, Richards, Hunsader, & Rubenstein, 2008). In mathematics the terms pupils already know from everyday life, can have multiple or totally different meaning in a formal context (e.g., square). To verbalize their thinking process, pupils need to develop their mathematics literacy, which can be challenging for some pupils due to literacy problems.

1.2.2 Mathematics in the curriculum

The aim for the 1st and 2nd grades is to create a foundation for understanding mathematical concepts and structures (e.g. numbers and decimal system), using tools and learning arithmetic skills. The Finnish National Core Curriculum for Basic Education (2016) sets a shared curriculum for the 1st and 2nd grade. Pupils are supported in their development of mathematical thinking, understanding of mathematical concepts and ability to solve problems. Teaching of mathematics should also provide opportunities for communication, interaction and co-operation and to utilize information and communication technology. The ways of instruction should be versatile, reinforce the

positive attitude and self-image as a mathematics learner. The learning should not be limited to school context but rather guide to notice how mathematics are present in the students' lives and more broadly in the society.
(FNNCBE, 2016).

The key content areas are thinking skills, numbers and operations, geometry and measuring, data processing and statistics. Thinking skills include comparing, classifying, identifying causal relationships and introduction basic programming (FNCCBE, 2016). These skills fall into the basic skill of understanding mathematical relationships that Aunio & Räsänen (2015, in Mononen et al., 2017) have described. During the 1st and 2nd grade pupils familiarize themselves with natural numbers first from 0 to 20 and then up to 100. Different arithmetic operations (e.g. addition, subtraction and multiplication) are developed in different contexts. Multiplication tables that need to be learned are 1-5 and 10. The concept of fraction is also introduced through simple examples. Geometry is introduced through naming and drawing shapes and observing 3D-environments. The measurement systems (e.g. metric system and time) are also introduced alongside basic data processing tools (e.g. charts) (FNCCBE, 2016).

The curriculum also requires that teachers use versatile ways of learning (e.g. games, play and problem solving) and introduce digital tools into the learning process (FNCCBE, 2016). The curriculum specifies that teachers should evaluate the level of mathematical skills in the beginning of first grade and offer support to learners with weaker skills. The assessment should be consistent, and feedback should be encouraging. The learning outcomes can be evaluated through speech, drawing, writing or the use of other equipment (FNCCBE, 2016).

1.2.3 Differentiation in mathematics

When a teacher notices that the pupil has some difficulties, the first step is to figure out what exactly is the reason for this difficulty. Mathematical basic skills are separate but have hierarchy and the teacher should be aware of these relationships when assessing the need for support (Siiskonen et al., in Ahonen et al., 2019). Teacher should also examine the quality and quantity of their teaching and proceed to differentiate as needed. Joutsenlahti and Tossavainen (In Joutsenlahti et al., 2018) propose that teachers should add more

languaging to mathematics lesson as it can help pupils to make their thought process visible both to themselves and to the teacher. When a teacher can see and understand how pupils understand mathematics, it makes planning and assessing the learning easier. This is also one the goals in the curriculum (FNCCBE, 2016).

Supporting basic mathematical skills in a classroom could be helping children notice mathematical issues in their everyday life (e.g., number of pupils in the classroom or how many potatoes they have on their plate), playing games with a mathematical agenda (e.g., UNO or Skip-Bo) or including mathematical terms into everyday dialogue (e.g., forward, backward, first, last, more and less) (Koponen et al., In Ahonen et al., 2019). For differentiating exercises teachers can either decrease the amount of task to help pupils to focus on the very basic skills. Very talented pupils can be offered more advanced extra task or problem-solving activities. All of these options are usually somehow included in the exercise books or teachers' material produced by the mathematics book publishers. Drilling exercises are good for supporting basic arithmetical operations since they promote retrieving the answer from the memory and help automatize these skills. For counting skills teachers can introduce different support programs to support learning more strategic skills (e.g., commutative operations like addition or multiplication) (Koponen et al., In Ahonen et al., 2019). More means of differentiating mathematics are introduced in the section *3.2 The 5D model*. The next chapter will move to discuss the other aspect of this research, CLIL education.

1.3 Content and Language Integrated Learning (CLIL)

In this research the focus is on learning L2 and especially in a Finnish CLIL context. L1 works as supporter and a mediator of L2 acquisition. Krashen (1985) proposes that second language learning happens on a subconscious level when exposed to comprehensible input just above learner's level proficiency. CLIL education offers these opportunities to learn language and to practise communication in a foreign language even before starting formal language lessons. I will first examine the development and background of CLIL education in Europe, then focus more closely to the Finnish CLIL context and then give examples of differentiating CLIL lessons.

1.3.1 Background of CLIL Education

CLIL is an educational approach that was created in the 1990's in Europe (Nikula, 2016). It refers to education where a foreign language is used as a language of instruction and it is both the target and a tool. It has a lot of things in common with other forms of bilingual education (e.g. immersion and content-based instruction) and there is not a set pedagogical rules that CLIL lessons should follow. The combination of language and content goals can be implemented in many ways. CLIL is most often done through English (Nikula, 2016). Ellis (2008, In Surmont, Struys, van den Noort, & van de Craen, 2016) addresses that CLIL education benefits from the support of formal language lessons because different types of learning takes place in these lessons. Teaching conceptual knowledge (e.g. grammar in a formal language class) creates explicit learning where as CLIL lessons create an opportunity for implicit learning. Implicit language learning means understanding and communicating through the target language and this activates the brain very effectively (Bialystok & Barac, 2012). CLIL classes also create a space for the learners to communicate in L2 where the grammatical or the pronunciation skills are not the focus of evaluation (Nikula, 2007, In Surmont, Van De Craen, Struys, & Somers, 2014).

Content learning in CLIL can be anything from one specific aim from the curriculum to a big multidisciplinary phenomena or a project (Coyle, Hood, & Marsh, 2010). In a collection curriculum, where subjects are very separated, the true nature of CLIL might not be realized (Nikula et al, in Nikula et al, 2016). Another issue that prevents CLIL from being successful was brought forward by Savignon (2004, Coyle, Hood & Marsh, 2010). Teachers appear to be aware of the theoretical side of communicative language learning, but the learning is still very much grammar (form) rather than meaning focused. In CLIL the aim is to learn content without perfect form of language at all times (Coyle, Hood & Marsh, 2010). Finland introduced a new more interdisciplinary curriculum in 2014 which gives even better opportunities to create a truly integrated curriculum for both language and content goals.

One way to look at the integration is to identify three different perspectives, as described by Nikula, Dalton-Puffer, Llinares, & Lorenzo (in Nikula, Dafouz, Moore, & Smit, 2016). They distinguish the institutional level which includes the planning of curriculum, level of participants which address the effect that each individual has on the interpretation of integration and the third level which are the classroom practices being

used. On the institutional level CLIL differs from regular classrooms since it mixes the curriculums of content subjects and language subjects. This mixing can create opportunities for new teaching practices and can lead to the realization that every teacher is in fact a language teacher.

According to Coyle (2000, 2002, in Coyle, Hood & Marsh, 2010) language is present in CLIL education in three different ways: language of learning, language for learning and language through learning. This means that language is needed to access the content of learning (e.g. water cycle in nature), to be able to work together (e.g. pair work to complete a task) and support their thinking process to allow deep learning (e.g. being able to utilize the principals of water cycle in a problem solving context). To better understand all the different components that are a part of CLIL, Coyle, Hood and Marsh (2010) created a 4Cs Framework (Figure 1). According to their model content, communication and cognition create the type of triptych as described earlier. That triptych exists in a culture (e.g. learner's own culture and intercultural understanding) and that furthermore exists in a specific context.

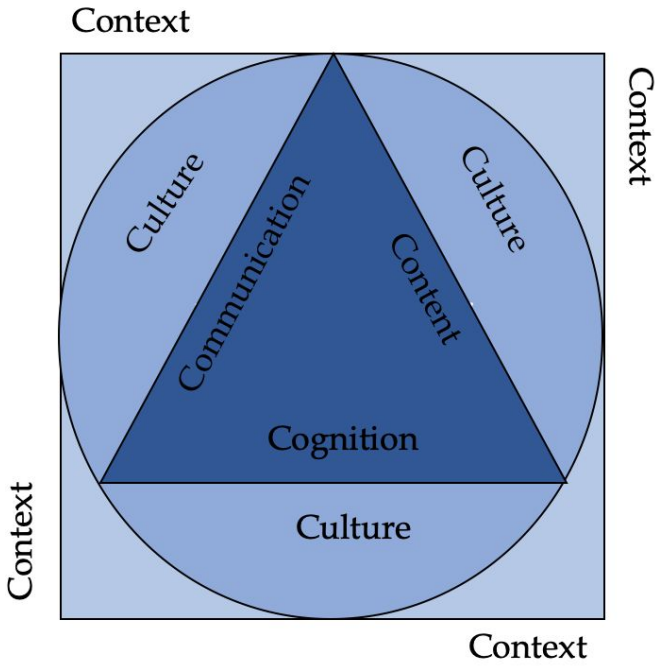

Figure 1. The 4C's framework (Coyle, Hood & Marsh, 2010, 41).

When looking at the benefits of CLIL education it has been noticed that CLIL students have better text production skills, better reading comprehension and language awareness to mention a few benefits (DESI-Konsortium, 2008). Roiha (2014) found in his study that CLIL teachers use both content and language learning connected means of differentiation, which supports both goals of CLIL even when CLIL is often seen as content-driven (Dalton-Puffer, 2011, 184). The CLIL programmes often have a language skill requirements or it is based on a choice and therefore the student cohort is selected (Nikula, 2016). This might also affect the learning outcomes and the need for differentiation. CLIL has also been praised to be a very motivational pedagogy, but since often times the students are chosen based on a test or an application it could be that these students are more motivated to begin with (Mearns, de Craaf & Coyle, 2020). Pihko (2010) has found that learners with lower language skills can feel language anxiety and therefore show less classroom activity. In this study the focus is on CLIL mathematics which also adds the mathematical skills of the pupils into this equation.

1.3.2 CLIL in Finland

Another language can be used in Finnish education either in a large-scale (e.g., total immersion) or in a smaller scale. If under 25% of the weekly hours are taught in a foreign language it is considered small scale and is referred to as language-enriched education. In both of these cases all the official information and communication with homes should be offered in the language of instruction. In the small-scale programs, the linguistic goals are not as ambitious, but it encourages pupils to use the target language in various situations. Large-scale bilingual education model requires at least 25 % of lessons hours to be taught in the target language. In total immersion education the language of instruction is used in majority of lesson hours, in the 1st and 2nd grade even up to 90%. In all of these programs it is important to support the development of the mother tongue. (FNCCBE, 2016).

The current Finnish National Core Curriculum for Basic Education (FNCCBE, 2016) does not describe any certain methods of language enriched education and therefore the methods vary from municipality to municipality (Peltoniemi et al., 2018). This creates a possibility for teachers to implement CLIL in their own classrooms quite freely. What the curriculum (FNCCBE, 2016) specifies is that the language of instruction should be either

Finnish or Swedish (with exception Samí or Roma) and another language (usually A1 language) can be used if it does not create a risk to the learning. Teaching of mother tongue and literature should be given in this language. The bilingual education aims to provide possibilities to learn and use language in authentic situations and across curricula (FNCCBE, 2016). The most common language for CLIL education in Finland is English, but there are classes using Swedish, Russian, French or German, Sami, Chinese and Spanish as well (Peltoniemi et al., 2018).

CLIL education in Finland has been surveyed a few times (Nikula & Marsh, 1996; Lehti, Järvinen & Suomela-Salmi, 2005; Kangasvieri, Miettinen, Palviainen, Saarinen & Ala-Vähälä, 2012; Peltoniemi, Skinnari, Sjöberg & Mård-Miettinen, 2018). The number of schools offering CLIL has been varying in past but growing since the last survey by Kangasvieri et al. (2012; Peltoniemi et al., 2018). Schools offering language enriched education are mainly located to Southern parts of Finland (Peltoniemi et al., 2018). Usually, the initiative to start offering bilingual education comes from teachers as they are interested in CLIL and pupils' language skills are seen as an important educational goal (Lehti, Järvinen, & Suomela-Salmi, 2006).

Instruction through target language is given broadly through different content areas (Lehti, Järvinen, & Suomela-Salmi, 2006). Environmental science was taught through CLIL in 85% of elementary schools and arts in 76% to name a few. Still teachers are worried about the sustainability of their programs because of changes in resources, difficulty in finding new staff with required education and the stiffness of the administration (Lehti, Järvinen, & Suomela-Salmi, 2006). The Finnish CLIL teachers are not usually native speakers of the target language but have good language skills in it which is quite similar situation to other European CLIL contexts (Marsh, Maljers, & Hartiala, 2001). Since the previous survey, the hiring situation has gotten better but the teachers are still mainly educated to teach in English-speaking programmes (Peltoniemi et al., 2018).

In Finnish research the learning outcomes of CLIL education have been really encouraging (e.g., Jäppinen 2005; Järvinen, Nikula & Marsh 1999; Laitinen, 2001). In 2005 Jäppinen studied the effects of teaching CLIL mathematics on cognitional development in 12 different schools (n=669) with pupils from ages 7 to 15 (Jäppinen, 2005). The conclusion was that CLIL education does support cognitional development since it can be more demanding than in a mother tongue mediated environment. When looking at the results

separately the results concerning mathematics was that in the first three grades (ages 7-9) there were no significance differences in cognition between the CLIL and control groups. In the next age group (ages 10-12) the cognitional level of CLIL learners in mathematics was higher than the control group but the difference levelled in the next age group. According to Jäppinen (2005) the reasons for these could be that the concepts became harder and the amount of Finnish instructions was therefore increased. The same issue was found also in the youngest age group with abstract topics. The small amount of schools offering systematic CLIL education and the variety of methods in use creates a challenge to get reliable results and to do comparative research (Kangasvieri, 2012). The next section will give examples of differentiating the CLIL lessons.

1.3.3 Challenges of CLIL education

In Finnish research it has been found that CLIL is suitable for pupils of all skill levels, but with certain caution (e.g. Seikkula-Leino 2002). CLIL education phases a challenge for the teacher since it differs quite a lot from traditional language education. CLIL education often requires pupils to communicate their thoughts and ask questions and often this requires some language which is above the pupil's skills (Coyle, Hood & Mars, 2010). Therefore, the same grammatical progression as in regular language education cannot be used but rather select what language is needed for the chosen activity. For this reason, CLIL education needs to be carefully planned. In Seikkula-Leino's research (2002, in Seikkula-Leino, 2007) it was noticed that pupils in non-CLIL classes were more likely to achieve maximal outcomes in content than pupils in CLIL classes. But both classes reach otherwise very similar learning outcomes and CLIL teaching did not affect learning outcomes in the mother tongue (Seikkula-Leino 2002, in Seikkula-Leino 2007). Since CLIL combines content and language learning it can be hard to assess. In Wewer's (2014) study of Finnish CLIL classes she found that CLIL assessment was irregular, incidental and often based on impressions. She proposed that schools would define their own CLIL curricula since the national core curriculum does not describe language-enriched education very specifically. She also proposed that assessment methods should be more evident-based and easily communicated to pupils and their families.

It has been seen in research that not all pupils enjoy or benefit from CLIL (e.g., Massler 2012; Pladevall-Ballester 2015; Ramos 2007). In Coyle's (2013) research some

students described CLIL as too difficult, boring or useless. In Pihko's (2010) research the students who didn't find learning through a foreign language pleasant were interviewed and they described their own language skills insufficient to study through CLIL. They also hoped for more support. Also, in Seikkula-Leino's research (2002, in Seikkula-Leino 2007) the pupils in CLIL classes thought of themselves as weaker language learners. These results are a clear sign of the need for teachers to focus more on giving positive feedback in CLIL education to reinforce pupils' self-esteem and help them to realistically evaluate their learning.

Roiha (2019) researched former pupils after twenty years of their CLIL education and in his study most examinees told that they feel like they have benefited from taking part in CLIL education. The former pupils told that they feel that CLIL improved their English skills and did not affect negatively on their content learning (Roiha, 2019). It also appeared that the participants felt that their positive English language self-concept and enjoyment of school improved because of CLIL (Roiha & Mäntylä in press, in Roiha 2019). This is very interesting since in Seikkula-Leino's research (2002, in Seikkula-Leino 2007) it was noticed that pupils in CLIL do not have as positive self-concept and are more critical of their knowledge in foreign language than pupils in non-CLIL classes. It is possible since there is over 17 years between these studies that even though pupils at the time had a more negative self-concept that when maturing and growing up their picture of themselves changed. Because Roiha's study was a retrospective one the pupils in both studies have gone through quite similar CLIL education of that time.

Since CLIL combines both language and content learning, learners might be facing challenges in either or both of them. Different learners have different levels of language and cognition and the relationship between these might vary (Coyle, Hood & Marsh, 2010). Therefore, CLIL education requires careful planning from the teacher to create activities that are both linguistically and cognitively appropriately demanding. Coyle, Hood and Marsh (2010, 43-44, adapted from Cummins, 1984) pictured this with a CLIL Matrix (Figure 2) which can help to balance the demands so that the activities create effective learning. It is insufficient to waste time on linguistic and cognitive activities that are too easy and pointless to put learners in a situation where both demands are too high.

If the cognitive demands of the activity are low, then it's possible to introduce a slightly more demanding language and conversely if the language is already familiar to the learner, then it's possible to introduce a bit more cognitively challenging tasks without it being unreachable and unmotivating for the learner. An example of this can be also found in Jäppinen's (2005) research of the Finnish CLIL education effects on cognitional development. Practical examples of differentiation on CLIL are further introduced in the section 3.2 The 5D model. Next, I will introduce the theoretical framework of my research which combines the theory of differentiation and CLIL education.

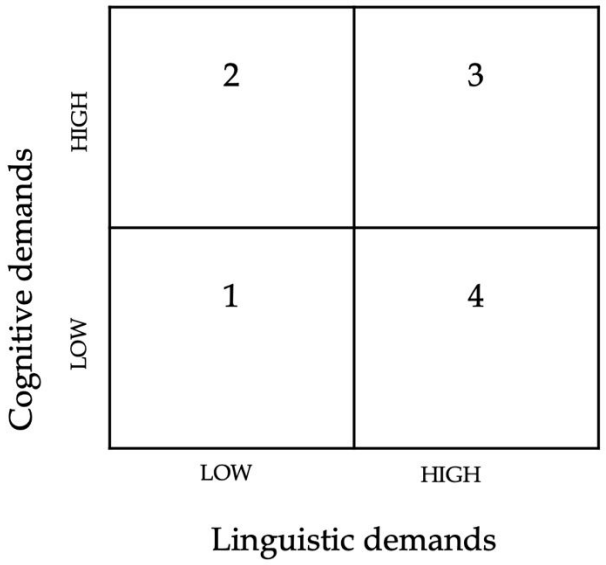

Figure 2. CLIL matrix (Coyle, Hood and Marsh (2010, 43-44, adapted from Cummins, 1984)).

2 THEORETICAL FRAMEWORK

CLIL combines both language and content learning and therefore it could be thought to require a lot of support in the classroom. Tomlinson (2014, 20) describes differentiation as a teacher's proactive response to student's needs. Teachers have been differentiating instruction long before it was a term and the classrooms where teachers differentiate are very student-centred. Teachers can differentiate the environment, content, process or the

product of learning according to their students' interests, readiness and learning profile (Tomlinson, 2014). Mononen et al. (2013) found that Finnish first graders know a lot about the topics covered mathematics during the first grade already in the beginning of the school year. Based on their research they call for differentiation in the mathematics classrooms. Could adding language enriched teaching methods be the answer to this call?

2.1 CLIL Mathematics

When pupils need to explain their thinking in one or multiple languages, it supports the deeper learning of the mathematical concepts and processes (Joutsenlahti & Tossavainen, In Joutsenlahti et al., 2018). Mathematic literacy, the ability to read, write, speak and listen to mathematics with understanding, is a skill that pupils start to develop and therefore the pupils can be considered mathematic language learners (Thompson et al., 2008). Joutsenlahti (2010) emphasizes the connection between language and mathematics and the importance of linguistics in the process of developing mathematical skills. If the role of the mother tongue is a significant part of the learning process in mathematics, potentially the same principal can be applied to foreign language as well. What gives CLIL pupils advantage over regularly schooled pupils are the benefits from more advanced metalinguistic skills (Surmont et al., 2014). Mathematics, like languages, requires understanding of abstract concepts, structures and problem solving (Joutsenlahti, 2005).

A recent study on CLIL mathematics suggests that CLIL education provided better learning outcomes both in language proficiency and subject matter (Ouazizi, 2016). This study used lesson recordings, questionnaires and mathematical tests to examine Belgian Dutch-speaking students learning mathematics through English. The conclusion was that CLIL education creates a highly motivating learning environment where new methods of teaching and learning are being used. Another study in the same context found that already after three months of CLIL mathematics education the mathematical skills had increased more than in education in students' mother tongue (Surmont, Struys, Vande Noort & Van de Craen, 2016). A recent study on CLIL mathematics in the context of the Czech curriculum draws attention to the way in which mathematical terms in both English and Czech language complement each other in a way that makes it possible for the pupils to create a deeper understanding of the content area than in just one of these languages

((Prochazkova, 2013). Since the terms in mathematical formula can be different in different languages it forces the pupils to learn the content rather than just memorizing the formula. Other languages also have more descriptive terms for shapes than others which can create better opportunities for higher thinking skills to be used (Prochazkova, 2013). This way the language of mathematics can create a connection between the L1 and L2. The language of mathematics is a very logical and basic functions work in the same way in every language.

For skills to be mastered, they require a lot of practice and repetition which can be unmotivating for children who struggle (Siiskonen et al., In Ahonen Aro, Aro, Lerkkanen, Siiskonen, Meronen & Bast, 2019). CLIL classes on the other hand are very motivating for children. Could it be that in a CLIL mathematics classroom the language motivates the children enough to make them work that much longer and therefore reach better learning outcomes? Lerkkanen, Kiuru, Pakarinen, Viljaranta, Poikkeus, Rasku-Puttonen, Siekkinen & Nurmi (2012) found in their research that pupils in a classroom with a teacher who uses child-oriented teaching methods had a bigger motivation towards mathematics. When teaching mathematics through a foreign language the means of differentiation should be adapted to fit both learning goals and abilities of these two aspects. In the next section the 5D model, one model of looking at different aspects of differentiation, is introduced.

2.2 The 5D model

Roiha and Polso (Roiha & Polso, 2018b; Roiha, Polso, & Repo, 2020) have developed a five-dimensional (5D) model to describe the practical ways of differentiating different aspects of education. The model is based on their practical experience in working as special education teachers and their perception of differentiation according to the description by Tomlinson (2014, in Roiha & Polso, 2018a). Their innovative model starts from practices used for the whole group and moves to smaller actions. When looking at education through this very practical model, it is possible to notice different possibilities what otherwise might be overlooked.

Differentiation can mean adjusting the content, pace or working methods during a learning process (Tomlinson, 2014). There is a lot of variety in methods since teacher can use their professional views and pedagogical freedom in this process. Differentiation is

sometimes called differentiated instruction and it describes how the teaching aspect is emphasized. In addition to teaching methods, differentiation should also be considered when arranging the schedules, designing learning environments, selecting materials and planning assessment. This section provides an overview of the 5Ds as outlined by Roiha and Polso (Roiha & Polso, 2018b; Roiha, Polso, & Repo, 2020). Although this model was not developed for CLIL-based education, how this model can be used as a theoretical framework is critically considered in the Section 3.5 Validity, reliability and ethical considerations. Practical examples of these dimensions are also introduced in both mathematics and CLIL education.

Teaching arrangements

The first dimension is the way education is organised. It includes everything from the schedules and collaborative teaching to remedial teaching and the number of teachers and learning assistants in the classroom (Roiha & Polso, 2018a). These arrangements do not always require more resources but rather could result in more efficient use of existing ones. One form of supporting students is flexible teaching grouping where the groups formed are non-permanent but rather serve a purpose for selected learning goals (e.g., specific topic of interest, communication or working style) (Roiha & Polso, 2018a). In these groups it is possible to give more targeted support which makes utilizing ZPD easier. This kind of grouping is also described in curriculum in all the levels of threefold support and therefore can be used with all pupils (FNCCBE, 2016).

Another organisational method is collaborative teaching (Roiha & Polso, 2018a). The term includes multiple different forms of shared teacher hood (e.g. supportive teaching, parallel teaching, complementary teaching and team teaching) (Saloviita, Aarnio & Kemppinen, 2016). It seems that collaborative teaching is not utilized to its full potential in Finnish schools. For example, Roiha (2012) found that 59% (n=41) of teachers rarely use co-teaching. To make co-teaching possible teachers can synchronize their schedules for example with other teachers on the same grade level, with the special education teacher or with some other teacher. These parallel lessons make it easier to use the resources to benefit for all the students. This shared time might not be easy to find but it could make teaching smaller groups within bigger class sizes possible (Pihko, 2010; Roiha, 2012; Tomlinson & Imbeau, 2010). Teachers can also arrange the schedule so that class is divided

in half. These split lessons are often used in the lowest grades for mother tongue or mathematics (Roiha, Polso & Repo, 2020).

Remedial teaching is one the means of support that are described in the curriculum (FNCCBE, 2016). The Basic Education Act obligates to give remedial teaching to a pupil who is left behind in their studies or who otherwise need support (BEA). It can also be offered proactively for example to ease feelings of insecurity (Roiha & Polso, 2018a). Pupils on all support levels can receive remedial education but according to Roiha (2012, n=41), the majority of teacher rarely give remedial teaching for CLIL classes which could be beneficial to reaching even better learning outcomes.

Learning environment

The second dimension in Roiha and Polso's (2018b) model is the learning environment which can include the physical classroom and the psycho-social learning environment which includes the class atmosphere, class culture and different types of relationships in the class (Roiha, Polso & Repo, 2020). These both affect the learning but in different ways. The psychical environment is probably the easier one to plan and change. The arrangement of seats and tables can either support different working methods or make using them harder. In CLIL different pair and group work methods are used often so the arrangement should be planned to make that easier to execute. Often times teacher might be decorating the classroom to their preferences, but the basis should always be to enhance learning (Roiha & Polso, 2018b). In a CLIL classroom the foreign language can easily be present in the learning environment. There could for example be name tags for different tools in the target language, maybe the agenda or other picture cards could have the foreign language translations next to them.

The psycho-social learning environment is also very important but unfortunately sometimes harder to plan or to have an impact on. It might even be hard for the teacher to realise the problems in it. For the teacher to be able to differentiate it requires a positive and accepting atmosphere in the classroom. The positive environment is especially important to pupils who have weaker skills or abilities in learning and development and the emotional support affects reading and mathematical skills (Siiskonen et al., in Ahonen et al., 2019). That requires a lot of work in the begging with a new group, careful

monitoring of the class culture development and immediate interference if any signs of bullying arise.

Teaching methods

Roiha and Polso (2018b) outline teaching methods as the third dimension of differentiation. These include all the pedagogical decisions and the working methods used in the classroom. A big part of teaching is giving students instructions and when doing so the different types of students should be taken into consideration. Clear and supported instructions give all students a possibility to understand what is going to happen and what the students are expected to do. Especially in the context of CLIL some visual aids to support the different steps of the activity are helpful for students. In differentiated instruction the nature of the subject should guide the choice of study technique and learners should be familiarized with all the different techniques to help them take more responsibility of their own learning.

To accommodate all different learners, teachers should try to use versatile teaching and working methods. Students can work individually, in a pair and in a group. Independent work is quite easy to tailor to each student but might take a lot of time. Pair and group work are maybe less time consuming, but co-operation skills might set a new need for differentiation. A way to differentiate the pace of different learners needing support from the teacher is using projects, contractual projects or workstations. Projects often include cross-curriculum goals and practising co-operation skills that contribute towards building the classroom atmosphere. In a contractual project, when the students are working on list of tasks, the high-achieving students are most likely working more independently and not getting bored as easily. This allows the teacher to give more support for the low-achieving students. Workstations again give the teacher the possibility to give support on the more difficult task when the students can work independently in other stations. This creates a natural setting for the use of different types of activities in one lesson.

Teachers can even give out differentiated homework. In Roiha's (2012) research 50% (n=41) of the teacher had given different tasks as homework to differentiate. Since homework is done without the help of a teacher and it should support what is learned in the lessons, the homework should also be differentiated. The development of early

mathematical skills is affected by the mathematical experiences' children get at home (LeFevre et al.,2010, in Mononen et al. 2013). Therefore, teachers could use parents' evenings to inform and support the parents with the learning process and helping with the homework. If pupils receive no support and get frustrated with the homework it can very negatively affect the whole learning process.

Support materials

The fourth dimension, the supportive materials, is probably the first method that comes to mind when talking about differentiation with teachers. These can be separated to the supportive materials and tools for learning and concentration. The problems of concentration are common and can be support in many ways, but the focus of this chapter is going to be the supportive materials and tools for learning.

The main material for learning in the Finnish mathematics classroom is the workbook. Most teachers rely on the teachers' guides and pupils learn the conceptual knowledge through working on their books (Perkkilä et al.., In Joutsenlahti et al., 2018). A good mathematics workbook offers enough practice in the pupil's current skill level and challenge inside the pupils ZDP (Perkkilä et al., In Joutsenlahti et al., 2018). Nowadays the publishers create differentiated versions of these books and additional materials available to purchase or incorporated into the books. The problem is that those are fixed to certain skill levels when in reality there is a variety of problems and skill levels that would need tailored material. Another problem considering these materials in this context is that they are not designed for CLIL education. Therefore, CLIL teachers are often left to their own devices when it comes to producing any material for their CLIL classes.

Other types of support material in mathematics could be building blocks, geometric shapes, abacus, decimal system and fraction tools. Being physically able to see, touch and move objects is beneficial for creating deeper understanding of the mathematical concepts (Joutsenlahti & Kulju, 2015). Having these visualisation materials benefit all students when learning abstract mathematical concepts (Koponen, Mononen & Puura, In Joutsenlahti et. al., 2018). Different kinds of tools and pedagogical games should be available for both high and low achieving pupils to either use during tasks, as an extra activity or a reward.

Different kinds of tools and materials are needed by many, but often there is not enough money budgeted for it (Roiha, Polso & Repo, 2020). Therefore, teachers are often very good at coming up with alternative solutions and creating new things from regular everyday objects and even recycled material. Digital material (e.g. applications and websites) can provide both digital versions of exercises in the workbook and visualisations of concepts that normally not would be easy to offer in a classroom (e.g. simulations). There are also a lot of games available for computers and other devices that can be used to differentiate the teaching. Games, both online and offline, are often motivating for pupils.

Assessment

The last dimension in this model is assessment. It is a vital part of guiding the learning process. Good quality assessment is not only evaluating the end product but giving the learner and their home information during the process (Roiha, Polso & Repo, 2020). There are a lot of different assessment methods, but the choice should always be based on the learning objectives (Roiha, Polso & Repo, 2020). Test, portfolios, pedagogical discussion, learning journal, presentations and projects are ways to summarize what has been learned and can be used for summative assessment. Teachers can use self and peer assessment, but these both require a lot of practice. Using ready-made assessment templates can help at first and the next step could be that students practice vocalizing their own learning and give compliments to peers. Positive peer assessment helps to build a positive classroom atmosphere (Roiha, Polso & Repo, 2020).

Assessment is really a tool for the teacher to plan, change and differentiate the teaching (Atjonen, 2007). Different ways of assessing the students should be versatile and give an opportunity for different types of learners to show their skills (FNCCBE, 2016). At the beginning teacher can use pre-assessment to gain information about the skills and difficulties in that class. Based on that information the teacher can plan a lesson plan and materials more suitable for the students. During the learning process the teacher should use formative assessment to both guide her own teaching and help the learners be aware of their own progress. At the end of the period the teacher can for example have a test, which is considered to be summative assessment, to see and show not only what was learned but also what needs to be covered again and how to develop the teaching furthermore. There is no separate evaluation for CLIL education mentioned or required by

the FNCCBE. Each municipality and schools can decide if and how the learning outcomes are being assessed.

At the first and second grade formative assessment is the most used form of assessment. Some tests might be given, but the grades should not be the only basis for the final assessment. During the first three years of school, there are no numerical grades given, only formative assessment (FNCCBE, 2016). Positive feedback, which is important to all learners, should also be differentiated to connect with the individual goals of each learner. Feedback can be given verbally or as a concrete reward (e.g. a sticker) but it is important to make sure that the chosen method is actually motivating for the students. Rewards should be given on both short and long-term goals. In a CLIL classroom one goal could be for example speaking only the target language for the whole lesson. Other small goals could be linked to the activities or behaviour like in a regular classroom.

3 THE PRESENT STUDY

The aim of this study is to better understand how CLIL mathematics is implemented and to find different means of differentiation through interviews and video recorded lessons. Observation as a research method allows me to see the ways of differentiation in its natural context (Tuomi & Sarajärvi, 2009). After analysing the transcriptions of recorded classes an interview frame was created and the teachers were interviewed to deepen the understanding about the themes (Hirsjärvi & Hurme, 2008). The observations and teachers' descriptions were classified according to the 5D 's model framework by Roiha & Polso (2018b). These two research methods, observations and interviews, combined should provide a broader picture of this phenomena (Hirsjärvi & Hurme, 2008;Tuomi & Sarajärvi, 2009).

3.1 The Research questions

The aim of this research was to examine how differentiation can be practised in CLIL classrooms in order to better understand the different kinds of approaches and activities that are available to teachers when differentiating the teaching of mathematics in the early grades. This research task was divided in to two sub-questions:

(1) How teacher implement CLIL mathematics in a Finnish CLIL classroom?

(2) What differentiation methods CLIL teachers are using in their mathematics classrooms?

To answers these questions, I used both observation and interview data. Video recordings were used to both see the implementation in action and to form interview questions to then reveal new aspects to answer these questions.

3.2 Participants and the context of the study

My research took take place in a Finnish elementary school, where they have a language stream. It means that at least 25 percent of the weekly teaching hours are held in English. This creates a very systematic CLIL path for pupils. The school is in process of developing its own CLIL curriculum, but at the time of the study they did not yet have one in place.

The video recordings were filmed in two regular CLIL math classes in the Spring of 2019 as a part of IKI-project[2]. The IKI-project is a research project by the University of Jyväskylä, Åbo Akademi and the University of Turku and the research permits are cleared with the parents through the IKI-project. From those videos I chose the mathematics classes and from those I narrowed it down to the first and second grade classes since the two share the same curriculum. I then contacted the teachers of these recorded lessons and scheduled thematic interviews with them for the Spring of 2020. Both teachers that I interviewed have been working as teachers for over 30 years and working in this certain school for multiple years. The teachers are referred to as Teacher 1 and Teacher 2 to protect their anonymity.

3.3 Data collection

The first step in this research was to observe video recordings of CLIL mathematics lessons and identify different means of differentiation in those lessons based on Roiha and Polso's (2018b,2020) model of 5 D's. After analysing the narrative accounts of recorded classes an interview frame was formed and the teachers were contacted again to arrange interviews. The goal was to deepen my understanding by interviewing them (Hirsjärvi & Hurme, 2008). Since considerable time had passed since the recorded lessons, I used stimulated recall video clips during the interviews. The observations and teachers' descriptions were classified according to the framework by Roiha & Polso (2018b). All together there were 43 pages of transcribed material. The analysis of these materials is described in the next sections according to the data collection method.

Schedule	Data	Time	Transcribed pages
May 2019	Video recordings	Teacher 1: 40 min 35 sec Teacher 2: 42 min	Teacher 1: 5 pages Teacher 2: 6 pages
May 2019	Field observation notes		Teacher 1: 3 pages Teacher 2: 1 page
March 2020	Interviews	Teacher 1: 40 min 12 sec Teacher 2: 54 min 8 sec	Teacher 1: 13 pages Teacher 2: 15 pages

Table 1. Data collection

[2] https://www.jyu.fi/edupsy/fi/tutkimus/hankkeet-projects/iki

3.3.1 Video recordings

After reading about the phenomena and familiarizing myself with the 5D's model by Roiha & Polso (2018), I proceeded to watch one 45-minute lesson from each teacher and used my understanding of the theory to look for different ways of differentiation during the lessons. To complement my own observations, I also had field notes by the researchers who had observed the lessons. I used those notes to confirm my own observations and to fill the gaps when the camera was not recording (e.g. beginnings of the lessons and in between video clips). The observations were transcribed into written form as narrative accounts which consisted of the main events during the lesson and any dialogue that seemed to reveal something essential. The 5D's model and the theory guided my attention. The following data excerpt is an example of the Teacher2 differentiating her instruction during the lesson.

> Teacher says: ''*Mä kerron kohta. Ensin englanniksi. How many books are there then all together*?'' Teacher writes number 7 on the board and draws a circle around the both numbers. Children start to mumble, and the teacher is nodding to them. A few of the pupils mark their answer. Teacher repeats the question. Teacher emphasizes: '' *323 books now and 7 more. Add 7. Nyt tulee suomeks*.''. Teacher repeats the question in Finnish. Most pupils turn quickly to their papers to mark an answer. (Teacher2).

With observations as a research method, it is possible to gain information that otherwise would be hard to access as it allows to see the phenomena in its right context (Tuomi & Sarajärvi, 2018). In this research the recorded lessons offered an opportunity to see the CLIL teaching methods in practice and help with the formation of the interview questions. Having recordings made re-watching the lessons and the focusing on different elements each time possible (Horsley & Walker, 2003). Even though the recordings do not show it and the lessons are not intervened by the researcher who is filming the lessons it is necessary to consider the effect the presence of the researcher, the camera and the other visitors in the classroom had on the behaviour of the teacher and the pupils (Tuomi & Sarajärvi, 2018). These recordings were made in the Spring of 2019 in the teachers' own classrooms. Based on these lesson descriptions I created individual and general questions for these two participants of this study. General questions were more based on theory and individual ones linked to an event from the lessons. The interview frame is further discussed in the next section.

3.3.2 Interviews

Interviews provided an opportunity to gain more understanding of how teachers themselves see and think of differentiation in a Finnish classroom from the perspective of two teachers with long work history in that field will probably give me a good insight (Tuomi & Sarajärvi, 2018). Even though interviews can be a time and money consuming as a method of data collection, in my research it was the best method to the compliment the observations. The video recordings themselves only show a part of the teaching situation and of course only a glimpse of what CLIL mathematics education is. With interviews it was possible to hear reasoning for certain events during the recorded lessons and to ask questions about aspects of differentiation in CLIL mathematics in general (Tracy, 2013). I used video-stimulated interviews to help the participants to remember the situations better after a significant amount of time and help them reflect on their own teaching practices (Clarke, 1997). For example, to understand the reasons for language switch in Teacher1's lessons, I showed the teacher that clip from the lesson and then asked him/her to explain her reasoning. Using video stimuli also allows the participant to observe the situation from the outside and not as an active part of events (Newby, 2014).

These semi-constructed respondent interviews were based on the considered themes derived from observations and the 5D's theory (Tracy, 2013). They were used to better understand differentiation. The interview guides were developed for participants individually, but it was flexible so that during the interview the researcher could react to the participants answers by asking more specific questions. The interview guide also gave reassurance to a fairly unexperienced research interviewer. The interviews consisted of two types of questions. First there were some general questions about the participants professional background and their implementation of CLIL and views on differentiation. This was to also help the participants feel more relaxed and allowed them to explain their thoughts more generally before being asked about their own teaching. This can help the participants to be more open about their own perspectives (Tracy, 2013). The other types of questions were about the video recordings considering certain details or situations in the videos. The interview questions were created after watching the recordings and recognizing moments and methods of differentiation in them (e.g. see Table 2).

The questions were written and put in order and clips of their lesson recordings were shown to each participant in-between questions according to the interview guide. The participants were given a list of questions before the interview to allow them to evaluate if they are willing to share these insights and help them to think about these themes before the actual interview situation (Tuomi & Sarajärvi, 2018). If during the interview there was some things that needed clarifying or some other interesting points were mentioned, it was possible to ask questions that were not included in the original interview outline. The interviews were transcribed for the analysis. The interviews were conducted through Zoom in the Spring of 2020. The video and audio files were stored according to the IKI project data storage guidelines.

Event	Timing from the recording	Interview question(s)
Teacher goes to the front of the class and starts to speak to the class in Finnish. She asks for the students to name some of the skills being practiced. T: '' Mitä taitoa tänään harjoittelit?'' [What skill did you practice today?]	Teacher 1/video2: 3:43	Tämä oli se oppitunnin ainut kohta, kun sinä vaihdoit kielen suomeksi. Voisitko kertoa miksi? [This was the only time during the lesson that you switched to Finnish. Can you explain why?]
Teacher walks to the front of the chalk board. T:''Tänään kokeilemme toisella tavalla. Nyt mä sanon aika helpolla enkulla ekaksi sen ensimmäisen päässälaskun. Odotan hetken. Kokeile siinä vaiheessa jo kun saat sen laskea. Sitten sanon myös suomeksi. First in English and second in Finnish.''[Today we are going to try in a different way. Now I say the first calculation in quite easy English at first. I'll wait a moment. Try to count it then when you are allowed. Then I will say it also in Finnish. First in English and second in Finnish.]	Teacher2/ Video1: 07:36	Videolla aloitte laskea päässälaskuja ja annoit ohjeet myös suomeksi. Voisitko kertoa, miksi vaihdoit tässä kieltä? [In the video you start to count mentally, and you also gave instructions in Finnish. Can you explain why you changed the language here?]

Table 2. Example of creating interview questions based on the recorded lessons.

3.4 Data analysis method

After completing the transcriptions, the analysis process could move forward. The first step was to read through the whole interview to familiarize myself with the content again as time had passed since the actual interviews. After re-reading the transcripts, I started to

colour code the text in to themes according to five dimensions of differentiation and an added main theme of ''Role and challenges'' for the general questions about the implementation of CLIL and differentiation. All of the themes were identified in both of the interviews and some parts were coded under multiple main themes.

Condensed form	Conclusion	Category	Theme
Oppilaille sanallistetaan se, ettei heidän tarvitse ymmärtää kaikkea ja harjoitetaan epävarmuuden sietoon. [Pupils are being explained that they do not need to understand everything, and withstanding uncertainty is being practiced.]	Teacher tries to create a safe atmosphere where pupils' self-efficacy is high and the amount of CLIL sessions can be increased. The knowledge of the pupils will help the teacher to more advanced learners, different tempers, reduce competition and anticipate negative feelings towards the foreign language. Pupils are being explained that they do not need to understand everything, and withstanding uncertainty is being practised. They are encouraged and given a lot of positive feedback. The social relations are taken into considerations when grouping pupils to decrease stress.	Safe atmosphere	Learning Environment
Opettaja yrittää ottaa huomioon myös oppilaat, jotka ovat arempia kielenkäyttäjiä, jotta he eivät koe tilannetta epäreiluksi. [Teacher is trying to also take pupils who are shyer about using language into consideration so that the situation is not unfair.]			
Opettaja pyrkii positiivisella palautteella ja kannustamisella vaikuttamaan positiivisesti myös oppilaisiin, joilla on negatiivinen asenne vierasta kieltä kohtaan. [Teacher is trying to have a positive influence on pupils with negative attitudes towards the foreign language with positive feedback and encouragement.]			
Oppilaat, jotka viestivät verbaalisesti tai non-verbaalisesti kielteisestä asenteesta kieltä kohtaan, pyritään ottamaan huomioon esimerkiksi oppilaiden ryhmittelyssä, jotta työskentelystä ei tule liikaa kuormitusta. [Pupils who signal negative attitude towards the foreign language are tried to be considered in grouping of the pupils so that the stress does not become too much.]			
Opettaja pyrkii omalla ohjeistuksellaan ennakoimaan lasten tunnetiloja ja ylläpitämään turvallisen ilmapiirin [Teacher is trying to foresee and affect the pupils' emotions and maintain a safe atmosphere.]			
Kun luokkaan saadaan luotua positiivinen ilmapiiri, on helppo lisätä CLIL-tuokioiden määrää ja vaativuutta, sillä oppilailla on vahva minäpystyvyyden tunne [When a positive atmosphere is established in the classroom, it is easy to increase the amount and demands of CLIL session because the pupils have strong sense of self-efficacy.]			
Opettaja pyrkii ennakoimaan tilanteita, joissa oppilaat saattavat kokea haasteita ja tarjoamaan ratkaisuja jo etukäteen [Teacher is trying to anticipate situations where pupils might feel challenges and offer solutions beforehand.]			
Opettaja pyrkii ehkäisemään vertailua ja kilpailua oppilaiden kesken [Teacher is trying to prevent comparisons and competition between pupils.]			

Table 3. Example of data analysis.

From the direct citations, initial codes that express the meaning in a condense form, were created. Based on these initial codes, preliminary categories were gradually developed. A conclusion of each category was created (e.g. Table 3). In this theory-driven analysis method the logic is abductive which means that the observations are used to find the most likely conclusion (Tuomi & Sarajärvi, 2018) and the clear division of the different

aspects of differentiation gave an opportunity to test this 5D's model in research purposes (Tuomi & Sarajärvi, 2018). The validity, credibility and other considerations of these research methods are discussed in the next chapter.

3.5 Validity, credibility and ethical considerations

Using triangulation, multiple research methods within one research, creates credibility (Patton, 2002) and therefore in my research I decided to combine interviews with observations. These two research methods created a lot of data, but the sampling was limited to two teachers in the same school and the answers are always limited by the amount of information the participant is willing to share (Tracy, 2013). The two participants were invited to participate personally and agreed to be interviewed but there was no relationship between the parties before these interviews. It is possible that they might have held some thoughts and feelings to themselves (Tracy, 2013). Based on these two teachers it is possible to observe about differentiation practices in a CLIL classroom, but these results do not include all of the possibilities that exist

I decided to use the 5D model by Roiha and Polso (2018;2020) as the framework for this study and test if it can be implemented in research use. The model is not scientificly developed but rather a practical model developed by teachers. This on one hand creates a challenge when there was not any previous research or guidelines to compare my use of this model but on the other hand it also allowed me to adapt this model in the best possible way to fit my exact needs. Unlike some other models, this model describes the practical implementations of differentiation and this made understanding the aspects very easy. Since the dimensions are not based on research, there can be inaccuracies in using this model and there might be some more suitable for example quantitative but in my qualitative research this model worked well.

The two teachers chosen for this research were experienced CLIL teachers and their experience was present in both the video recordings and interview data. This means that the two were given an equal opportunity to share their insights and during the analysis of the data it possible to recognize all the main themes from both of the participants data. This can be called saturation since in a theory-lead research the aim is make findings about the existing theory, in this case the 5 D's of differentiation (Tuomi & Sarajärvi, 2018). When

inviting the participants into the interviews I informed them that the interviews would take about 1 hour each. When starting the interview of Teacher 1, they informed me that they only had 45 minutes which meant that there was not as much time to make more questions than the interview outline that I had. This could affect the depth of the answers and created a difference between the two interviews. Since the interviews were conducted after almost a year since the lessons recordings it is possible that the participants did not remember all the details from these situations. It is also possible that since they now teach in another class that they might mix their reflections with things in their presents classroom or that they shared things from their previous classes. These responses provide information about differentiation in CLIL outside of my scope but can reveal important insights.

4 FINDINGS

The goal of this research was to better understand how CLIL mathematics is implemented in a Finnish CLIL classroom and to find out what means of differentiation are being used in a CLIL mathematics classroom. To find answers to the research questions I analysed the data and the findings are presented in the following chapters.

4.1 How teachers implement CLIL mathematics in a Finnish CLIL classroom

The lessons recorded in the Spring of 2019 were both very different from one another. Teacher1 was teaching half of the class and their topic was numbers between 10 and 20. One of their activities during the class was a game of ''What's missing'' where a numbers between 10 and 20 were written on the board and one was erased while the pupils had their eyes closed. Pupils opened their eyes and tried to figure out which one was erased. The other activity was a shop play with soft toys. Teacher had written price tags on the toys and pupils had number cards to show the amount of money they had. In Teacher2's lessons the activities were mental calculations, checking the homework and working with mathematics workbooks and she was teaching the whole class. In Teacher1's lessons the pupils were more actively involved in the activities and communicating. The Teacher2's class was more teacher lead, and the activities were more about individual work. Both teachers use English as an organisational language in their classrooms.

When analysing the general responses about teachers' CLIL mathematics lessons, the answers mainly described the general implementation and the goals the teachers set for their CLIL education. Teacher described that CLIL education provides a good bases for formal English lessons even though written English is not yet taught during first and second grade. Both teachers highlighted the importance of continuity for systematic development of language skills, but the school does not yet have a shared CLIL curriculum in place. The teachers also mentioned that they teach the same class for more than a year and that of course helps to know your pupils better. This in combination with the shared CLIL curriculum could provide continuity. When describing the

implementation of CLIL both teachers preferred CLIL sessions over entire lessons. One the two described that her goal is to have one hour of CLIL a day. The biggest challenge for both teachers was that they found it hard to arrange the required number of hours a week for CLIL classes, due to other duties required of them. The feeling of inadequacy seems to be quite common among teachers and even the teachers who have a long work history feel this way. It would seem that there is not enough time in a teachers' day to day work schedule to use on planning the lessons. This was also brought up by the participants.

> ''Jotenkin tuntuu, että jo se että siinä tulee sellanen että sen saa, käytän nyt sanaa suoritetttua. Tota, että se tuntuu tällä hetkellä tavotteelta, joka aina liian usein karkaa. [Somehow it feels, that even that I manage to, I am going to use the word accomplish. So, it feels at the moment as the goal which too often runs away.]'' (Teacher 2)

Both teachers thought that mathematics is a good subject for CLIL education because of its clear structure and lack of need to understand written language when learning the basic skills. Based on the teachers' responses it also seems that the combination of mathematics and CLIL is good fit. The pedagogy is given a lot more thought and the subject matter is very simplified to the core content during CLIL classes. It seems that the more simplified form of information makes it easier to learn and this way CLIL can even support learners who would otherwise struggle. Since the language of mathematics still stays the same even though the language around it might change, it creates good opportunities to differentiate vocabulary for different pupils. This was also described by Teacher2 in the following data excerpt.

> ''Mutta, että ite mä oon kokenu, että matematiikka on erittäin hyvä oppiaine millä niin kun lähtee liikkelle, koska se on semmonen selkee rakenteeltaan ja siinä kun ymmärtää perusasiat niin lapsille tulee semmonen olo, että kun he tekee matikkaa niin ei se niin kun haittaa minkä kielinen tää kirja on''[But, I have experienced that mathematics is a very good subject which to begin with because it is clearly structured and when you understand the basics then children feel that when they do maths it does not matter what language the book is].'' (Teacher2)

4.2 How teacher differentiate their CLIL mathematics lessons?

The teachers described differentiation to be important in CLIL classes, but the implementation to be different between students and subject matter. They also made a point that not everything can be differentiated or that at least everything should not be made easier. This implies that both of the teachers first think of differentiation being for the pupils with learning difficulties rather than for the talented pupils. It was also interesting to notice that the teachers seem to focus on the differentiation of goals rather than working methods. The teachers mentioned that they are unsure about all the different ways of differentiating or that they use them unilaterally. These claims are supported by a contradiction in the descriptions of their methods in their interviews and the narrative accounts. The feeling of not doing enough is also brought up. Both teachers seem to be undermining their use of differentiation tools as seen in the data excerpts below. In reality both teachers mentioned several ways of differentiating different aspects of their teaching and both use differentiation in the recorded lessons as well.

> ''…et sä kuitenkaan voi niin kun kaikkea opetusta aina sille niin kun vetää alaspäin''[… however you can not drag all education downwards.]'' (Teacher1).

> ''Tavat on aika yksipuoliset sanotaan näin. [The means are quite one-sided let's say that.]'' (Teacher2)

> ''Jatkuva olo tässä on että liian vähän. Kalvaa. [The constant feeling is that not enough. It bothers.]' (Teacher2)

4.2.1 Teaching arrangements

The teachers' descriptions about the teaching arrangements could be divided in to five different categories; *co-teaching*, *other resources*, *planning*, *flexible grouping* and *remedial teaching*. These themes follow the different aspects as described by Roiha & Polso (2018;2020).

Co-teaching in their CLIL classes was used when they had a native teacher assigned to the class but otherwise, they do not have other teachers in their classrooms during CLIL lessons. The teachers mentioned the reason for this being the schedule. One of the teachers mentioned that she co-operates with the formal English teacher. They have made a distribution of work where the class teacher focuses on teaching vocabulary and the language teacher focuses on teaching grammar. The other resources mentioned where a

learning assistant and a special education teacher, but their resources are not connected to CLIL but rather the normal amount that is assigned to every class. Both teachers evaluated that they had good resources as it is and that the need is more essential somewhere else for these limited resources. It could be that since there are no possibilities for additional resources, these teachers have accepted the current situation and manage to work with what they have got. The teachers described that they are given schedules by the principal which determine whether they can use parallel lessons or split classes. There are no extra resources for CLIL education, and the teachers prioritize mathematics and mother tongue classes for those four classes that they are able to have with only a half a group at the time. Learning to read and write during the first two grades are the most important goals and therefore this is very understandable. Teacher1's lesson recording was from a lesson for one half of the class and there were only ten pupils present. When working with a smaller group of pupils the teacher has a better opportunity to observe and support the pupils. With more time per each pupil, the teacher can assess their learning and keep the exercises in the ZDP of each pupil.

> '' Me ollaan myös sovittu jonkin verran työnjakoa tässä formaalienglanninopettajan kanssa. -- Me ollaan sitten selkeesti sovittu, että hän esimerkiksi ottaa nää kielioppiasiat ja muut että mä käyn lähinnä sitten sitä sanastoa mitä me tarvitaan muussa oppiaineiden tunnilla. Niin tuota ja jotain fraaseja ja muuta mutta että ei oo niin esimerkiksi kieliopin kannalta tää ei oo tää CLIL sillein yksin mun harteillani. [We have agreed on division of work here with the formal English teacher. – We have clearly agreed that he/she for example takes these grammar things and others so that I will take mostly vocabulary that we need during the lessons of other subjects. So that and some phrases and others but this is not, like considering the grammar, completely only on my shoulders.]'' (Teacher2)

Teacher2 also explained that she designs the schedule for the day so that it does not necessarily follow the given schedule but rather creates a logical entity that considers all the goals for the day. For example, she would cover any new topics during the morning classes when it is easier for the pupils to concentrate. This type of planning supports all learners, and it makes it easier to build coherent themes around chosen phenomena. Teacher2 also described that she sometimes groups students according their social relations to support the learning of some insecure students. Offering this emotional support in a CLIL classroom is very important. For remedial teaching the answers vary between the two teachers. Teacher1 told that she offers remedial teaching for CLIL education when it is about an essential basic skill (e.g. how to tell the time). Teacher2 in

the other hand does not give remedial teaching for CLIL education. But both teachers agreed that the need for remedial teaching is mainly in learning difficulties in subject matter. This seems interesting since the language enriched education is a part of the curriculum and therefore remedial teaching for CLIL is justifiable.

> ''Etenkin kun me ei olla aina menty, ei olla menty vielä lukujärjestyksen mukaan että meillä on ollu käytännössä vain ne tunnit, jossa toinen opettaja tai toinen opetustila, niin ne on ollu kiinteillä paikoilla. Että mä oon sitten aina sen päivän kun oon suunnitellun niin oon miettiny sitten että mikä tehdään millonkin. Että jos tulee vaikka uus asia niin se on sitten vähän aamumpana että sitä ei laiteta sinne enää viimesille tunnille ja semmosta strategiaa[Especially since we have not always gone according to the schedule and we have had only the lessons taught by another teacher or a classroom booking in solid places. So that if there is a new topic, we take that more towards the morning so that it is not put to the last lessons and that type of strategy.]'' (Teatcher2).

> ''En kauheen paljon käytä, mutta kyllä mä käytän välillä ja jos tulee jotain semmosta niin sitten mä voin ottaa. Että tukiopetusta periaatteessa on yksi tunti viikossa ja on kuitenkin oppilaita, joilla on ihan matematiikan ongelmia ja kirjottamisen ongelmia niin ei sitä voi laittaa pelkästään englantiin. [I do not use very much but I do use sometime and if there comes something then I can take it. So there in principal is one hour of remedial education in a week and when there are pupils who have troubles in mathematics and writing so it can not be all put to English.]'' (Teacher1)

4.2.2 Learning environment

According to the teachers' answers the goal for both teachers is to create a *safe* and *inspiring social-emotional environment* for learning. To achieve this, they described giving a lot of positive feedback for even the smallest use of English and trying to get at least one pupil excited and that pupils will get the rest of the class excited as well. The teacher will begin by creating small sessions where the pupils' self-efficacy is reinforced and only after that the teacher will extend the time of the CLIL sessions. After a while the teacher might also use the pupils as assistants and give them an opportunity to play the teacher. In Teacher1's lesson this seemed to create a lot of motivation in the class and increase participation from all the pupils.

> T:''I am really glad seeing so many hands!''(Observation from the lesson of Teacher1)

> Teacher asks for one of the pupils to come up front and help: '' I give you the pointer and you can be a teacher for a while.'' (Observation from the lesson of Teacher1)

The key for maintaining a safe environment is being familiar with the pupils and that teacher considers the temper, background, feelings, social relationships and tries to reduce competition between pupils. Both teachers highlighted the importance of teaching the same class for several years to be able to familiarize themselves with the pupils. Teachers also have to explain to the pupils that they are not able understand everything being said

during the CLIL session and pupils are supported to withstand uncertainty. This came up in both lesson recordings and the interviews and examples are shown in the data excerpts below. In the lesson recording for Teacher1, the length of the lessons is 45 minutes and the teacher used English throughout the lesson. At the end she switched the language to Finnish and gave praises to pupils for understanding so well. In the lessons of Teacher2 the language of instruction was switched up between Finnish and English throughout the lesson. In both lessons the teacher knows her class and is familiar with their language levels and history.

> ''No, ensinnäkin sen, että lapsilla on niin kun turvallinen olo, että niiden ei tarvii hätääntyä. Että ne selviää ihan varmasti jos ei ne heti tiedä sitä ymmärrä niin kohta kerron suomeksi. Eli tavallaan se, ettei tuu kenellekkään se paniikki että ne menee lukkoon. Apua, nyt tulee enkkua. [Well, first of all, that children feel safe, that they do not need to become distressed. That they will certainly get through if they do not know it, understand and in a minute, I will tell in Finnish. So that anyone does not panic, and they do not not have a lock. Help, now comes English.]'' (Teacher2)

> ''Kyllä se niin kun sitten kun oppilaitten kanssa todetaan, voidaan todeta tunnin lopuksi hei että tää meni ihan hyvin näin, hienosti ymmärsit vaikket kaikkea ymmärtänyt. [It is with the pupils that when you can say with them at the end of the lesson that hey this went really well like this, you understood well even if you did not understand everything.]'' (Teacher1).

> Teacher asks if the pupils understood her English instructions throughout the lesson. She points put that she spoke a lot of English and the pupils nod. Teacher gives them praises for understanding so much during the lesson. (Observation fron the lesson ofTeacher1).

> T:''Tänään kokeilemme toisella tavalla. Nyt mä sanon aika helpolla enkulla ekaksi sen ensimmäisen päässälaskun, odotan hetken. Kokeile siinä vaiheessa jo kun saat sen laskea. Sitten sanon myös suomeksi. First in English and second in Finnish. [Today we are going to try in a different way. Now I say the first calculation in quite easy English at first. I'll wait a moment. Try to count it then when you are allowed. Then I will say it also in Finnish. First in English and second in Finnish.]'' (Observation from the lessons of Teacher2)

4.2.3 Teaching methods

Both teachers brought up a lot of different aspects about their teaching methods in CLIL classes. The descriptions could be placed under four categories*: student-centred teaching*, *goals and assessment*, *differentiation* and *language level*. When teachers were describing their differentiation in CLIL education they both brought up, that they do not differentiate in CLIL classes as much as they do regular classes. They often use CLIL as a mean of differentiation for other classes. Usually differentiating down for these teachers could be decreasing the amount of task for the pupil. For differentiating up they use other teaching material available (e.g. old textbooks) and digital material (e.g. apps and VILLE).

> ''Mutta sanosinko että jos ajatellaan kokonaisuudessaan että minkä verran esimerkiksi muuten eriytän, en kaikissa oppiaineissa mutta esimerkiksi matematiikassa ja äidinkielessä etenkin niin en hirveen paljon, en niin paljon eriytä sitten taas CLIL-juttuja kun muita [But I could say that if we think

in general that how much I otherwise differentiate, not in every subject but for example in mathematics and mother tongue especially so not that much differentiation in CLIL like in other subjects.]'' (Teacher2

Pupil-centred teaching and motivation for learning was heavily highlighted by both teachers. Means for motivating the pupils were creating an inspiring atmosphere towards CLIL, choosing topics that are interesting for pupils and using age appropriate activities, like games and songs. Phenomenon based projects were mentioned by Teacher1 as a natural teaching method for differentiation since it created natural variation between students. Both teachers also pointed out that the class they are teaching, which subject is being taught and what is the topic of the class have an effect on the CLIL session. From their descriptions and the lessons recording it seems that they are balancing in the CLIL matrix trying to find the balance between linguistic and cognitive demands (Coyle, Hood & Marsh (2010, adapted from Cummins, 1984).

''Tai sitten eriytetään niin että se on niin kun on joku teema, asiakokonaisuus mitä tutkitaan niin kun nyt meillä on kakkosluokalla ollut toi huone niin sitten he on itse miettineet että mitä asioita siellä huoneessa on, että minkä he haluaa oppia englanniksi. Ja se tavallaan vie sitä sinne ylöspäin ja sitten tavallaan joku sitten vaan jollain ne on vaan ne muutamat, joku keksii kymmenen tai viisitoista mitä hän haluaa laittaa eli jätetään avaruutta. [Or then we will differentiate so that there is a theme, a topic that we are looking at like now during the second grade we have had a room so then they have themselves thought that what things do they have in there and they want to learn in English. And that kind of takes it upwards and then sort of someone who only has a few, someone comes up with ten or fifteen which they want to put so let's leave room.]''' (Teacher1)

The way teachers plan their teaching methods is determined by the goals and assessment of learning and consider the topic and class size before choosing what type of activities to use. When teaching a bigger and more active class, they favor listening exercises. With smaller classes teachers use more language producing and drama exercises. To ensure that the learning goals are being met, the teachers have all the pupils do the same homework which gives an opportunity to monitor not only the whole group but individuals as well. Teacher1 also mentioned that she sometimes systematically checks the skills of each students about a certain topic (e.g., how to tell the time). Even though the teachers emphasize planning as a key to successful CLIL, it was interesting that Teacher2 also pointed out that improvised CLIL session seem to be some the best ones she has had.

''-- mutta aina niin kun sitten miettiny, että mikä tähän tilanteeseen sopii, että jos on joku ympäristöopin tai matematiikan asia, joka kaipaa just sitä kertausta ja harjotusta ja niin sitä voidaan ottaa niin kutsutun CLIL eli englannin tunnilla niin kun jatkaa sitä asiaa mitä on otettu jo jossain muussa aineessa. [-- but always I have wondered that what would fit in to his situation like if there is a topic from science or mathematics which could use some repetition ja practice and then I can take it in a so called CLIL or English lessons and continue the what we have already started in another subject.]'' (Teacher1).

''Musta tuntuu että CLIL:n kanssa elää kädestä suuhun ja parhaat CLIL-toteutukset tulee aika spontaanisti, että äkkiä saa jostain jonkun ihan siinä tilanteessa jonkun inspiraation että kokeillaas tätä englanniksi ja sitten se lähtee menemään [I feel with CLIL that I am living from hand to mouth and the best CLIL implementation come quite spontaneously that you suddenly get the inspiration quickly in the situation that let's try this in English and from there it goes.]'' (Teacher 2).

An aspect of teaching that is very important to CLIL education is the level of language being used. Both teachers brought up that they think about the language they use in the classroom before the lessons. To support the speech teachers should use body language and gestures to emphasize the main message. To support the understanding even more, it is useful to use different means of illustration and repetition. Teacher2 mentioned that she sometimes changes the level of language from pupil to pupil as differentiation. The first and second grade pupils do not learn written English and therefore the instructions need to be short, simple and possibly supported with pictures. The process of moving from Finnish instructions to English instructions is slow and subtle where the teacher supports the learners with written instructions, pictures and repetition. In the lessons of Teacher1, she only spoke English to the pupils where as Teacher2 kept switching between the languages multiple times during the lesson. This kind of differentiation really requires knowledge of the group and individual pupils so that the language is easy enough but at the same time the pupils are still learning new words and getting more familiar with the language. The following data excerpts show examples of events from data where the teachers used some visual elements or the mother tongue as a support method.

''Ja sitten sanastoa mun pitää miettiä, että se ei oo niin kun liian vaikee. Että mä käytän niin kun semmosia käsitteitä että he ymmärtää. Ja nyt sä esimerkiksi huomasit että mä en niin kun itse ruvennu kääntämään. Sitten mä voin kääntää tai jos tarvitaan tai jotain käännösapua niin oppilaat auttaa ja ne kääntää toiselleen. Että mä niin kun tavallaan suljen sen suomen kielen niin kun hetkeks pois. [And then I need to think about vocabulary so that it is not too difficult. So that I use concepts that they undertand. And you for example now noticed that I did not myself start to translate. Then I can translate or if it is needed or some help with the translation when pupils help and they will translate to one another. So I will kind of close off Finnish language for a moment.]'' (Teacher1)

T: ''Please listen! Okay, little notebooks.'' picks up a blue notebook and shows to the class. '' There are 37 little notebooks. Big notebooks.'' writes to the board and shows a big notebook to the class. ''There are 6 less than little ones. How many notebooks there are all together? Okay, little notebooks 37, big ones 6 less than the little ones. 6 less than. How many all together? Okei ja sitten kuuntele tarkasti''. Teacher repeats the question in Finnish. (Observation from the class of Teacher2).

''Mä koitan toistaa tiettyjä sanoja. Koitan puheessa painottaa, niin kun tossakin oli three hundred and thirty-seven. Sitten tota, usein mä niin kun käytän kehonkieltä. Turn your books upside down. Että niin kun käyttää mitä on käytettävissä.'' [I will try to repeat certain words. I try to emphasize certain words when I speak like in there it was three hundred and thirty-seven. Then I often use body language. Turn your books upside down. So that I use what I have available.] (Teacher2)

T: '' Have you found your cards? When you have found your cards, take them in your hand this time. Not on your desk.'' Showing the cards in her hand ''Take them in your hand and please come here.''

> Showing the circle again. '' We make a circle on the floor. So come here. Sit down here on the floor. Take the cards in your hand.'' (Observation from the lesson of Teacher1)

> ''Eli taululle on yleensä laitettu nää. Alussa siellä oli tavuviivat ja sitten luki vaikka piirrä ja sitten mä laitoin sinne piirrä-sanan viereen draw ja sitten pikkuhiljaa se oli samalla lapulla. Tossa oli draw ja sitten mä saatoin vilauttaa että piirrä. Sitten siihen jäi kuitenkin se draw näkyviin eli niin kun siinäkin kielessä siirryttiin pikkuhiljaa suomesta englantiin ja äidinkielen jutut on sitten taas aina suomeksi [So these are usually on the board. In the beginning there was hyphens and then there would read like draw and then I would put draw next to the Finnish word and then gradually it was on the same paper. There would be draw and I could quickly show ''piirrä''. Then there would be draw visible so that there the language would gradually change from Finnish to English and mother tongue things are always in Finnish.] ''(Teacher2)

With most of the subject matter both teachers always start by teaching the new topic through Finnish and move on to revising it through English. This could mean for example teaching the new mathematical process in Finnish and then moving to practicing it in the workbooks that are in English. Because the language skills of students in the first and second grade are on a very concrete level, the discussion about learning skills and thought processes are always in Finnish, but Teacher1 emphasizes that these are still very important discussions to have and promotes CLIL with the pupils. When the pupils get older and their language skills grow, they can start to have these discussions in English as well.

> ''Mutta että nyt mennään yleensä suomenkielisen materiaalin kanssa ja sitten kun lasten kirjat on enkuksi niin usein sitten katotaan tavallaan vaihdetaan enkuksi okay what do you do in this exercise? Think. Add ja niin kun haetaan sieltä niitä ydinsanoja. Katotaan että jokainen niin kun pääsee alkuun. [But that now we usually go with the Finnish material and then because the pupils' books are in English then often we look, kind switch to English, okay what do you do in this excercice? Think. Add and like search for the main words there.]'' (Teacher2)

> Teacher goes to the front of the class and starts to speak to the class in Finnish. She asks for the students to name some of the skills being practiced: '' *Mitä taitoa tänään harjoittelit?* [What skill did you practice today?]'' (Observation from the lesson of Teacher 1)

4.2.4 Support materials

As mentioned before teachers can use different types of support materials to complement their teaching. Many of the materials mentioned by the participants are things that can be utilised in a non-CIL class and there might be more material they use in their non-CLIL lessons. The materials are also limited to not include any objects or aids that teachers could use to support pupils with attention difficulty or any kind of disability. The types of support materials used by these teachers in their CLIL classes were divided into three different categories: *Foreign language material*, *daily activities and organisation* and *visual aids*.

Since CLIL education is only practised by a small number of classes in Finland there really is not that much teaching material that could be purchased from the same publishers as the other books for example. There are mathematics workbooks in English and Teacher2 is currently using one. Teacher1 had used one before but is now using a Finnish workbook because she felt that it created too many challenges for understanding that the exercises were always in English. In Teacher2's class new topics are usually taught in Finnish with Finnish digital material and then they move on to the workbook together. There used to be digital material in English, and it was seen as a useful tool. Teacher2 also uses the Finnish version of the same workbook as a check-up book and she guides her pupils to use that as an opportunity to check if they had understood the exercises independently. For exams the pupils can choose the language.

> ''Että siinä tulee sit sen haasteet että sitten ei kaikki tahdo niin kun ymmärtää niin sitten tulee ne sanallisten tehtävien haasteet. Että siinä on niin kun kovempi homma sitten vielä. [There becomes the challenge of that not everyone tends to understand and the verbal tasks are challenging. That there is more work there then.]'' (Teacher1).

> ''Tällä hetkellä valitettavasti meidän käyttämästä Kymppi-sarjasta niin siinä ei oo englannin kielistä digimateriaalia. Muutama vuosi sitten oli ja mä koin äärettömän paljon auttavaks ja ihmettelen miksei SanomaPro hyödynnä. [At the moment there is unfortunately no English digital material from the Kymppi-serier that we use. A few years ago I did and I felt that it helped a lot and I wonder why does not SanomaPro utilize it.]''(Teacher2)

> ''Yks juttu vielä mikä mulla tuolla luokassa on ollu että kun lapset etenee niin siellä on ollu pari saman kirjasarjan suomenkielistä versioo. Että esimerkiksi kun he menee sille lisätehtäväaukeamalle, jos he ei ymmärrä mität tässä tehdään, he voi käydä itse katsomassa sieltä suomenkielisestä kirjasta. Ja se on semmonen niin kun omatoiminen, että se ei sillon niin kun keskeytä ope ope mitä tässä tehään. [One thing that I have had there in the classroom is that when pupils move forward that there has been a few Finnish versions of their book there. For example when they move to the additional task pages if they do not understand what they need to do they can go and check by themselves from the Finnish book. And that is kind of self-acting so it does not interrupt like teacher teacher what do I have to do here.] ''(Teacher2)

Often teachers have to either develop material themselves or search for it from the internet. Both teachers emphasize that there is not a shortage in materials, nor do they feel that it would be any kind of problem to find them online. Since the materials online are often designed for schools outside of Finland, teachers should always go through them before using them to make sure that they fit into our curriculum. Teacher2 brought up that there might for example be religious content that does not work in our non-confessional religion education. Any online content or apps are being used but the experience is that the language is too easy and does not offer that much language learning for pupils when the content is appropriate for content learning. The opposite challenge comes with the independent reading of English books. Teachers2's experience is that the books that match

the student's language level are usually too childish or the topics are not interesting to them and the books that would be have too difficult language because they are designed for native speaker children. She would like to see more books that are especially designed to language learners.

> ''Netti tulvii kaikkea. Se välillä mietityttää, osan materiaaleista kanssa pitää niin kun todella käydä itse läpi. Esimerkiksi englannin kieliset uskontoon liittyvät jutut. Niitä on jenkeistä tulee tulvimalla kuten arvata saattaa mutta ne pitää aina kattoa ihan kaikki läpi. Että siellä pysyy tavallaan se sellasena, että pystyy toteuttamaan uskonnon opetusta tunnustuksettomasti ja sillain että se ei oo minkään kirkkokunnan värittämää. Että se on semmosta niin kun yleiskristillisyyteen pohjaavaa. Että materiaalista ei oo kyse. [The internet is full of everything. It makes you think somotime with some of the material you really need to go through it. For example the English material connected to religion. A lot of it comes from the United States like you can guess but it always requires going through it yourself completely. So that it stays that you can carry out non-confessional religion and in a way that it is not colored by any religion. So that it is based on general Christianity. It is not about the material.]'' (Teacher2)

> ''Mä oon jo aika paljon mä oon ohjannu sitten esimerkiksi kertotaulujen harjottelussa englanninkielisille sivustoille. Ne on usein sitten niin yksinkertasia kuitenkin että ei siellä sitä kielitaitoa niinkään tarvii. Että jos sä harjottelet kertolaskuja enkuks että choose the color of the, valitsee vaikka kärryn värin millä mummokärryllä sitten kilpailee kaveri niin se on aika pientä kuitenkin. [I have guided quite a lot, like in practicing multiplication, into the English language websites. They are usually so simple that you do not need language skills there. Like if you practice multiplication in English like choose the color of the for example the cart which the grandma uses, to compete a friend with so it is quite small in the end.]'' (Teacher2)

> '' Sitten meillä on tota reppukirjat. Aikasemmin kun oli pulpetit niin ne oli pulpettikirjat, mutta nyt kun meillä ei oo pulpetteja oppilailla niin me puhutaan reppukirjoista. Niin nyt muutamalle lapselle niin oon koittanut ja nyt jo sitten kolmella lapsella onkin englannin kielinen reppukirja. Eli näitä helppoja kirjoja, mutta tän ikäsille on vähän hankalampi motivoida sitten ottamaan jotain sellasta kirjaa mihin hänen kielitasonsa riittää, kielitaito riittää, koska usein ne on sitten niitä melkein taaperoille tarkotettuja. -- Eli sellanen olisi varmaan hyvä kielen oppimisen kannalta jotenkin laajempaan jakeluun tulisi sellaset helppo englantia. Semmosta selkoenglantia sisältävät kirjat, missä ois toistoa enemmän ja ehkä niin kun selitettäisi kuvilla jotain sanoja tai mikä saattaa olla vieraampia. Mutta että ne ei olis ihan tämmöstä että Pipsa menee potalle, Pipsalla on hyvä olo. Että se ois vähän niin kun sellasta kirjallisuutta mikä tän ikästä motivoi. -- Että sellaselle olis tilausta ja saattaa hyvin olla, että jossain onkin. [Then we had backpack books. Previously we had school desk with storage space we had school desk books. But now when we do not have storage we call them backpack books. So now I have tried an English book for a few kids and now three pupils already have an English book. So these easy books but for this age it is more difficult to motivate to take some book that the language level is suitable because often those are meant for toddlers. – So it would be good for language learning that there would be books with easy English in larger distribution. Books in plain language English where there would be more repetition and maybe like explaining some words with pictures or what might be difficult. But that they would not like this Pipsa goes to potty, Pipsa is feeling good. That it would be more like literature that motivates this age group. – So there would be need for that and there might have these somewhere.]'' (Teacher2).

As the written English is not yet a goal in the first and second grade classroom a lot of the material visible is about the daily activities and organization of the classroom. Both teachers use activities like checking the calendar and daily schedule and have pictures and text (e.g. names of the months and seasons) up on the board for this. This offers opportunity to discuss about mathematics related topics daily and support pupils to notice

mathematics in their everyday life. Teachers did not really describe any mathematics related materials from their classrooms, but often times early education classrooms do have numbers displayed on the walls.

To help pupils understand and learn from teaching given in a foreign language both teachers described visual aids they use. To support instructions given in English teachers use pictures of the classroom objects needed for the exercise (e.g. scissors), visually pointing out the important parts by bolding or highlighting the written instructions and the transition from Finnish to English is done subtly. To support their teaching both teachers use a lot of cards, pictures or classroom objects to offer something to concrete to help better understand what is being said. An example of this was in Teacher1's lesson where she showed what she wanted the pupils to do under the document camera to support her oral instructions. Pupils can also produce support pictures themselves (e.g. drawing pictures to a song lyrics). They also use mathematics specific tools like multilink but those are not necessarily because of CLIL mathematics but support all learning. In the activity recorded from Teacher1's lessons the pupils were practicing counting with soft toys that had price tags on them and in Teacher2's lessons she used pencils and notebooks to demonstrate the objects to the pupils.

> ''No, kaikennäköstä että jos puhutaan hedelmistä niin sitten otetaan hedelmäkortit tai muovihedelmät ja sitten voi just tommosta ostamista ja myymistä voi kaikennäkösillä tarvikkeilla. [Well, many things like of we talk about fruits there are cards about fruits or plastic fruits and then it can also be that kind of buying and selling.]'' (Teacher1)

> ''Niin lauluja he harjottelee sillä tavalla, että he piirtää niihin pikkukuvia säkeistöjen mukaan tai mä laitan valmiiks siihen pieniä kuvia niin siellä se on taas se scaffolding joka auttaa sitä laulun niin kun ymmärtämistä, että mistä siinä puhutaan. [Songs they will practice by drawing small pictures to fit the verse or that I put them there already so that there is again that scaffolding which helps to understand the song, what is said in there.]'' (Teacher1)

> T: ''The pencils. Okay, so this is a pencil.'' Teacher walks to the nearest pupil's desk and picks up a pencil and shows it to the class. Teacher walks back to the board and draws a square on it. ''This is a box. There are 300 pencils in this box. 300 pencils. Teacher… '' points at her/himself ''me. I take 60 pencils, 60 away…'' shows a gesture at the same time. ''…How many are left? I take 60 pencils. How many are left?'' (Observation from the lesson of Teacher2).

4.2.5 Assessment

When talking about assessment, they descriptions could be divided into two categories: *assessment targets* and *assessment methods*. The school does not yet have a shared CLIL curriculum and therefore the teachers have to independently set the learning goals for their students and the there is no evaluation in the intermediate or school year report. This means that the goals are not the same between the different classes. For example, Teacher1 described that she assesses each student individually to make sure that each of the students reach the goals and Teacher2 on the other hand described that she assesses the class as a whole. The shared goal for both of the classes is to reach the level of the language where the pupils are able to follow English instructions and function accordingly. Both teachers brought up that any learning goals need to be made clear to the pupils and that the teaching should cover all the goals set for CLIL education. Teacher1 also mentioned that in evaluation of the subject matter the learning goal for the certain subject is prioritised over the language learning goal (e.g. mathematics exam). Since assessment is such an important tool in planning good quality education it is important that the teacher at least monitor the whole class but preferably each pupil individually.

> ''Ja sitten tietenkin siitä pitää kiinni, että on olemassa jotkut semmoset minimitavoitteet mistä pidetään kiinni mitkä pitää kaikkien niin kun harjoitella ja niin kun tavallaan vaatia heiltä. [And of course you need to hold on that there are some minimum goals which everyone must reach and is demanded of them.]'' (Teacher1).

> ''Ja sillon niin kun tavotteet on siinä, että oppilas pystyy niin kun harjottelemaan sitä. Että olis jos hän pystyis esimerkiksi ne englannin kielisten ohjeiden, ohjeiden annon tai englannin kielisen materiaalin kanssa niin kun harjottelemaan sitten sitä. Että niin kun tavallaan mulla ei oo niin kun oppilaskohtaisia tavoitteita. [And when like goals are that the pupil can like practice it. So that if they could practice it with English instructions or English materials. Like I do not have personal goals for pupils.]'' (Teacher2)

> ''Että tota, mun mielestä niin kun matikassa ei oo ihan tärkeintä se että koetilanteessa niin kun ilman muuta käännän lapselle, että jos hän kokee, että tarvii. Että hän ei tiedä mitä tässä tehdään tai mä huomaan kun lapsi palauttaa mulle kokeen, mä huomaan, että hän on ymmärtäny tän väärin niin sitten mä sanon mitä siinä piti tehdä ja hän lähtee uudestaan tekemään. Että mun mielestä matematiikan ei oo sellanen että siinä katotaan sitä että osaako se sitä enkkua vaan että osaako ne universaalit laskutoimitukset. Että se millä kielellä se ohje sitten menee niin opettaja varmistaa se. [So in my opinion it is not the most important thing in mathematics so in test situation if a pupils feels that they need a translation, I will translate to them. Like they do not know what to do or if they return the teat and I notice that they have misunderstood, then I say what they needed to do and they will do it again. So in my opinion mathematics is not a type subject where you should see of the pupil knows English or not but rather that do they know the universal calculations. So what language the instructions are, the teacher should make sure of it.] ''(Teacher2)

When describing the methods for assessment in CLIL education the teachers brought up that use mainly formative assessment. The pupils in the first and second grade do not

yet read or write English and that makes summative testing challenging. Teacher1 described that she had tested pupils with a test that had a drawing and an oral section, but this of course is quite demanding for the teacher to do constantly. The most used forms of formative assessment used by the two teachers are teacher observation and giving positive feedback to the pupils during classes. Teachers also monitor the homework as all the students are assigned the same exercise. The learning to learn and self-evaluation skills are on a very low level during first two grades. Teacher1 describes in the data excerpt below that it is important to start teaching simple ways of self-evaluating and to have conversations about these skills in Finnish. Homework is good opportunity for differentiation and if parents can support the work at home the pupil benefits even more.

> ''No mulla oli tuota, mulla oli sitten oikein semmoset oikein kokeet, että mä pidin niin kun kaikille. Että mulla oli siinä eri näkösiä semmosia osioita että piti niin kun kuunnella mitä mä englanniksi sanon ja hänen piti kirjottaa se numerona ja sitten mä en muista mitä kaikkea mulla oli. Mulla oli niin kun eri tavalla heidän piti tehdä mutta ei koskaan niin kun kirjaimilla kirjottaa. Kuitenkin monta osiota ja sitten mä pidin vielä suullisen kokeen kaikille yksin ja mulla oli varmaan kymmenen numeroo kirjotettu paperille listaan ja sitten mä pyysin että he sanoo siitä ne kaikki läpi ja mä kuuntelin. Eli mä niin kun monella tavalla testasin sitä ymmärrystä ja tuota noin sitä myöskin sitä omaa sanomista. [Well I had like, I had like a proper test that I held for everyone. There I had these different sections that they would need listen to what I say in English and they would need to write it in numbers and then I do not remember all the things I had in there. I had that they needed to do different things but never like write in letters. Anyway many sections and then I also held an oral exam for everyone individually and I had like ten numbers written on a paper on a list and then asked them to say all of them and I listened. So that I tested the understanding in many ways and also the producing.] ''(Teacher1)

> ''Kotitehtävämökki, jolloin me voidaan sen avulla kerrata, että mitä on menty ja miten on osattu. Ope saa vähän tietoa ja oppilaat myös. [The homework box so that we can use it to go over what we have talked about already and how is it going. Both the teacher and pupils get knowledge from that.]'' (Teacher2)

> ''Mutta sitten mä ajattelen että sitten se on kuitenkin tärkeä asia. Että mulla kulkee ne ajattelun taitojen opettamiset tässä koko ajan niin kun rinnalla niin musta on hirveen tärkeetä että he miettii tämmöstä asiaa ja sitten he oppii perustelemaan sitä. Niin kun nytkin niin mä varmaan sain sieltä jotain perustelujakin ja mä koitin kannustaa heitä siihen että miksi. Että he selittäis tarkemmin ja aina että mitä taitoja. Että kun pienikin pystyy jo miettimään. [But then I think that it is a important thing after all. That the teaching of thinking skills goes alongside here all the time and therefore I think that it is really important that they think about these things and learn to give reasons. Like now I probably got some reasons from there and I tried to encourage them to think why. So that they would explain in more detail and that always what skills. Even a young one can think about it.]'' (Teacher1)

5 DISCUSSION

The goal of this research was to better understand the implementation and role of differentiation in a CLIL classroom. The findings of this research are now discussed in relation to the theoretical framework of this study and the literature. I begin with the first research question and the proceed to the second question by discussing each of the dimensions by Roiha & Polso (2018;2020). After these the limitations of this study and further research will be discussed.

5.1 CLIL mathematics supports the learning of basic mathematical skills

The lessons recorded for this study were very different from one another and showcased different CLIL methods in mathematics education. The lessons were very age appropriate and the learning outcomes could be found in the NCCFBE (2016). Both teachers brought up the challenge of finding the time in the schedule for the required amount of CLIL hours in a week. In a first and second grade this would mean 5 hours a week (BEA). Both teachers preferred to have CLIL sessions instead of full lessons and this of course is a good fit for the young age of the pupils. The sessions are short enough to maintain interest and not get frustrated with weaker language skills. The school was in process of developing their shared CLIL curriculum and when that is implemented it should support a stronger continuity through their whole CLIL education.

Comparing the two classes also shows how quickly the development in mathematics happens with young children. In the first-grade class they are learning the names for numbers between 10 and 20 and already in the second-grade mathematics they are counting with numbers up to one thousand. Both of the classes were repetition for something the pupils had already learned in Finnish before. This kind of repetition aims to automatize the basic arithmetic operations so that more complicated calculations would be possible (Aunio & Räsänen, 2015, in Mononen et al., 2017). In conclusion of both teachers' interviews it seems that CLIL is seen as form a differentiation for mathematics. CLIL as a

pedagogy offers the content in a clear and concrete form and motivates the pupils to practice more.

The participants described mathematics as a good subject for CLIL education. They said the clear structure makes it easy to learn and when the basics are being understood the language does not matter that much. Pimm (1987) described mathematics as language and when pupils learn the symbols and understand the logic of it, teachers can combine it either with Finnish or English, but the language mathematics will stay the same. The languages together give better opportunities for pupils to create deeper understanding of the content (Prochazkova, 2013).

5.2 Differentiating CLIL Mathematics

The ways of differentiating young learners' CLIL mathematics are of course very similar to differentiating any learning and like in Roiha's (2014) study these teachers too use both content and language connected means of differentiation. There are some aspects that are highlighted (e.g. language of the teacher and materials) and the young age of the pupils means that no written English language is yet demanded from the learners but it can be introduced if the pupils seem to be ready for it. The pupils learn to write and read Finnish during the first grade, so the use of written Finnish is also limited during the first grade.

Both teachers made clear statements that they do not differentiate their CLIL sessions as much as they would differentiate other subjects. They also pointed that not everything can or should be made easier which gives an impression that they see differentiation as lowering expectations for pupils. Both participants had hesitations about what can be called differentiation and Teacher2 expressed feelings of inadequacy. Teacher2 pointed out there is not enough time anymore as a teacher to do everything and maybe this is reflecting on the differentiation of lessons. When looking at the lessons through an observations framework there were several methods of differentiation being used in both of the classrooms. Since teachers' self-efficacy beliefs and knowledge about differentiation have an effect on the way they implement it in the classroom (Aunio, Ekstam, & Linnanmäki, 2017; Roiha, 2014) teachers would probably benefit from in-service training and observing their lessons from time to time, in a way assessing themselves.

5.2.1 Teaching arrangements are not often a choice

In the model by Roiha & Polso (2018b) teaching arrangements include all the schedules, teacher resources, remedial teaching and flexible grouping. In this school the schedules are determined by the principal and there is not really any co-teaching in CLIL education. This could also be since only one class in the each age group is implementing CLIL education and in a big school co-operation between different age groups can be hard to schedule. For the same reason flexible grouping is not used in this school for differentiating CLIL education. When the class teacher, like Teacher1 for example, works as the formal English teacher there is no possibility for co-operation with the English teacher either. CLIL education, which can feel demanding, would benefit from teachers co-operating and therefore it is desirable that the teachers work together in planning of the bigger outlines and developing a shared curriculum (Wewer, 2014). This process was in progress at the time of this research.

The resources given to the classes are the same as given to any other class. Both teachers felt that they had good resources even though they rarely get a learning assistant or other teachers in the classroom. There really is not much that can be done to funding and other limitations for the staff placement, but could it also be that since the pupils are chosen to the CLIL class among applicants that the pupils have better learning capabilities and are more motivated (Mearns, De Graaff, & Coyle, 2017; Nikula, 2016; Ouazizi, 2016) and therefore there are not as many problems in the classroom? In the light of statistics there should be pupils with learning difficulties in every classroom (Aunio & Räsänen 2015, in Mononen et al., 2017) but again the pupils' selection process makes it a possibility that those pupils do not enter the CLIL programs as much. Some CLIL schools have a stricter pupil selection policy and others offer it to everyone (Peltoniemi et al., 2018).

Remedial teaching, which is one of the means for differentiation mentioned in the curriculum, divided the two participants. The other one offered remedial teaching for CLIL and the other did not. Since in CLIL language and content is so intertwined (Coyle, 2000, in Coyle, Hood & Marsh, 2010) the support in language related issue could benefit the content learning or the other way around. For example, covering the topic ahead of time with the pupil to both support learning but also support the emotional side if the pupil is nervous about using English. Roiha (2013) found that majority of teachers do not

give remedial teaching for CLIL education but since the language-enriched education is included in the curriculum it should not be excluded from the remedial teaching.

5.2.2 A positive environment supports CLIL

In this study I focused the perspective to psycho-social learning environment, since most aspects of physical learning environment are equally important in all forms of education. Some aspects of physical learning environment more connected to CLIL are mentioned in the *'Materials'* section. A positive and supportive psycho-social learning environment of course benefits all education, but especially reading and mathematical skills (Siiskonen et al., in Ahonen et al., 2019). Therefore, teachers in CLIL classes should make sure that they focus on creating a positive environment in their class. The participants also had found this to be a key element in their CLIL classes. Since the same teacher spends multiple years with the same group, it makes this a lot easier because they are able to build better relationships with the pupils. The CLIL sessions are started with small activities for shorts periods of time and once positive experiences are gained the sessions are made longer and more difficult topics can be introduced.

Not all pupils enjoy CLIL classes because it can be quite demanding and requires a lot of communication even above the pupils' skill level (Coyle, 2013; Coyle, Hood & Marsh, 2010; Pihko, 2010). In this study I did not look at how the pupils felt about the lessons or the CLIL education in general. In previous research by Roiha (2019) it was concluded that some pupils feel positive about their CLIL education in retrospect but in the study about the current CLIL pupils by Seikkula-Leino (2002, in Seikkula-Leino, 2007) the pupils felt insecure and were critical of their foreign language skills. The participants in this study explained how they verbalize to pupils that they might not understand everything, and they practice withstanding uncertainty little by little. This combined with a lot of positive feedback helps the pupils keep trying.

5.2.3 CLIL as a pupil-centered teaching method

CLIL education is a very pupil-centered learning approach (Marsh, 2012) and differentiation creates pupil-centered teaching. These two are a great combination and this explains why CLIL might be seen as a form of differentiation by these teachers. When teachers plan their CLIL session, which they both emphasize is very important, they

consider the size and skills of the pupils. The most important thing is the goal for the lesson. Since there is no shared CLIL curriculum, the teachers choose on objective mainly from the mathematics curriculum. Therefore, there is risk that the lessons could become too content driven.

Mononen et al. (2013) were calling for differentiation for the mathematics lessons and based on the descriptions of the two participants it seems that if pupils are very talented in mathematics, teachers will increase the amount of English for them to give them the extra challenge. If a pupil is struggling in a CLIL mathematics lesson, they will decrease the difficulty of English or even switch to Finnish completely. This kind of thinking is also the base for CLIL matrix described by Coyle, Hood & Marsh (2010, adapted from Cummins, 1984). If the cognitive demands are high (e.g. learning a new mathematical concept) the teacher makes the language much easier than when dealing with something familiar. In Teacher2's lesson, the pupils were being tested on mental calculation and as the teacher noticed that the combination of demand on cognitive skills and languages skills was too much for the pupils, she lowered the language skills demand by switching back to Finnish. Teachers might also decrease the amount of exercises for pupils who seem to struggle and offer extra exercises from other workbooks or apps for talented pupils.

Observing these two teachers it was easy to point out a few key features of their CLIL teaching. Both teachers used short and clear sentences and supported their speech with gestures and different visualizations. Both teachers brought up in the interviews that the level of language needs to be considered and maybe even practiced before the CLIL lessons. They also mentioned that the teaching is more effective if complimented pictures or objects to visualize the topic. Both of these features would be beneficial in a L1 classroom as well, but especially when operating in a foreign language. Visualizing is also important for young learners in mathematics (Koponen et al., In Ahonen et al., 2019).

Teacher2 pointed out in the interview that some of her best CLIL sessions have been spontaneous, which speaks for experience but there are also different ways teachers can ensure quality teaching in their CLIL sessions (Coyle, Hood & Marsh, 2010). The 4C's and the CLIL matrix (Coyle, Hood & Marsh, 2010) are good tools for the teacher to utilize while planning any CLIL session. Even though projects are mentioned by both researchers (e.g. Roiha & Polso, 2018b) and the participants mentioned them as a good

method for differentiating CLIL, the nature of mathematics as a subject does not really support that as learning method for learners this young.

As mentioned before, in this school the teachers do not use co-teaching in CLIL classes, but they utilize some split lessons in CLIL mathematics. Usually the half of the group comes in earlier in the morning and the other group has the same lessons in the afternoon. This was the case in Teacher1's lessons. The soft toy shop activity would have been quite different with the whole class present. In the lesson for Teacher2, when the whole class was present, they did more teacher-lead activities and worked independently which makes it easier for the teacher to help the pupils who need the support the most with content related problems. Another way teacher can optimize the support to where it is needed is to plan workstations were the others are quite easy for the pupils to do independently or in a group and place themselves to the station which covers the most complicated task or topic (Roiha & Polso, 2018b).

5.2.4 CLIL materials are easy to find

In contrary to previous research (e.g. Roiha, 2014) the participants in this study did not feel that the lack of material was the reason for lack of differentiation. They both described that they either make the material themselves, use old materials or search for new ones online. Both of them had also used an English language mathematics book, but Teacher1 had moved back to the Finnish version. They both had noticed that the L2 book creates more work for the teacher and more difficulties for some pupils. What the teachers were hoping for are digital teaching materials in English and more literature directed to L2 language learners. Since there are no complete CLIL material packages offered by any publishers, teachers just have to put in the effort in finding and making the materials. This can feel like a burden at times.

Even though written English is not yet a goal for the first two grades, teacher might place it in sight for pupils to possibly implicitly learn (Bialystok & Barac, 2012). Both participants had a calendar up in the classroom which pupils can learn the dates, months and seasons. Other things could be labels for classroom objects or craft supplies. Any types mathematical or other terms could be visible as posters or pictures. These are all good for

vocabulary practice which is one of the most important goals for the beginning of CLIL education.

5.2.5 Assessment of the learning in CLIL is essential for differentiation

The assessment of and for learning is an essential part of Finnish education (FNCCBE, 2014), but still the Finnish CLIL education does not have any set shared goals or methods (Wewer, 2014). Teacher need the assessment data to evaluate the process and the end result of learning. The pupils' ZDPs are under constant development (Mercer, 2008; Vygotsky, 1978) and efficient teaching in that zone requires that teachers are aware of their pupils' development level. Assessment in the beginning of the learning period gives teacher knowledge about the pupils' skill level and makes the documentation of the learning process easier. Assessing the pupils would also make differentiating and planning easier (Atjonen, 2007).

Most of assessment in CLIL education is formative and a very common form is giving positive feedback, which is also main form of assessment for first and second grade (FNCCBE, 2014). Both of these teachers did that a lot during the recorded lessons and emphasized during the interviews. Positive feedback also contributes to positive classroom environment. The school in questions is in the process of developing a CLIL curriculum. Both the teachers have been working in the field and in this school for a long time and have had time to create an understanding and a vision of the goals of CLIL education. Teacher1 explained how she evaluates pupils individually where as Teacher2 focus on evaluating the class as a whole. Teacher1 had also sometimes tested her pupils with summative assessment. The CLIL education is not evaluated in the intermediate or school year report.

The learning outcomes of Finnish CLIL and non-CLIL pupils in mathematics within the first few school years does not differ (Jäppinen, 2005), but CLIL classes do develop students' metalinguistic skills that benefit their understanding of different languages, abstract concepts and problem solving (Surmont et al., 2014). Therefore, it is quite impossible to make distinction between assessing mathematical skills and CLIL education. Although CLIL education should be evaluated as its own unit and not as a part of formal English or mathematics assessment it needs to be acknowledged that the CLIL sessions

support the learning in the formal English lessons as well as in mathematics and vice versa (Ellis, 2008, in Surmont et al., 2016). As mentioned by Dalton-Puffer (2011) CLIL can be quite content-driven. When asked about the priority of the learning goals for the CLIL mathematics sessions, Teacher2 stated that in test situations the content goal is more important than the language goal. As CLIL aims to be a dual-focused approach the the langauge does not need to be perfect all the time (Coyle, Hood & Marsh, 2010), it would be important to develop an assessment tool to evaluate both language and content goals in CLIL specifically.

5.3 Limitations and further research

This research was is master's thesis research which means that the researcher is only practicing becoming a researcher. The topic is quite complex and not studied in Finland a lot, but a new model for looking at differentiation was recently published by Roiha & Polso (2018;2020). These together created a challenge since there was not a tested version of this model and barely any research of this topic to confirm the results. The research was conducted with almost a year later from recording the lessons which of course created a challenge. The video-stimulated interviews helped the participants to remember the specific lessons better.

The researcher has studied in the JULIET programme in University of Jyväskylä and was therefore familiar with CLIL education and is used to studying in English, writing this thesis work in English was quite the challenge. Another challenge was set by the COVID-19-pandemic. The pandemic did not affect my lessons observations since they were done a year earlier but the interviews were pushed back by a few weeks because if that.

To further research the themes of this study, it would be interesting to conduct a larger scale research about the mean of differentiating in Finnish CLIL classrooms. The 5D's model works as a good general model, but more detailed research frame based on it could be developed and the results could benefit teachers in their processes of both teaching and developing CLIL. Another interesting topic would be to look at teachers view of differentiation after setting the CLIL curriculum in place.

CONCLUSION

Differentiation is a support tool for education. Teachers should plan their teaching and pedagogy based on differentiation and different aspects of education should be considered while doing so (Tomlinson, 2014). To help teachers in doing so, Roiha and Polso (2018;2020) have created a five-dimensional (5D) model which divides the different aspects into more concrete and smaller pieces. The teaching arrangements, learning environments, teaching methods, support materials, assessment can all be observed individually to recognise all the possibilities for efficient differentiation according to the needs.

Content and language integrated learning (CLIL) is a foreign language teaching model where the content and language goals are equally important. In the Finnish curriculum these language enriched methods are divided according to the number of hours per week and if over 25% of weekly hours are taught in the foreign language, it is considered large scale language enriched education (FNCCBE, 2016). The participants of this study were working in this type of school in the first and second grade. To better understand how differentiation and CLIL mathematics education are implemented together, the teachers' mathematics lessons were recorded for observation in the Spring of 2019 and interviews were carried out in the Spring of 2020.

Differentiated education allows pupils to develop in their own individual pace and when the pupils are being guided and are working in their ZDP, it creates more interest towards mathematics (Vygotsky, 1978;). The differentiation methods used by the two teachers were versatile and different from each other. Teaching arrangements were mostly decided by the principal or decided due to other factors and the teachers felt that the resources were good in their classrooms. Both teachers emphasized the importance of creating and maintaining a safe and inspiring classroom atmosphere to support the pupils with withstanding uncertainty or negative feelings that the use of foreign language might cause. Giving a lot of positive feedback is important and can have huge effect on learning mathematics (Siiskonen et al., in Ahonen et al., 2019).

CLIL education as a pedagogy is a very pupil-centered method and it naturally creates a lot of differentiation for pupils because teachers need to recognize the most important content goals and use very concrete language and teaching methods complemented with simple language and clear instructions. Both teachers preferred short sessions of CLIL and used them as repetition for topics covered in Finnish mathematics lessons. Both teachers seemed to be thinking of these CLIL sessions as a mean of differentiation for regular mathematics. In these sessions the teachers would balance the cognitive and language demands according to the CLIL matrix (Coyle, Hood and Marsh (2010, 43-44, adapted from Cummins, 1984). Both teachers used a lot of concrete visual aids to support their teaching. Teachers would also use their gestures to help pupils to understand.

In contrast to previous research both teachers expressed that the lack of materials is not the reason for differentiation challenges. A variety of self-made and educational material (e.g. foreign language workbooks and digital materials) were used in the classrooms. Teachers were using increasing or decreasing the number of exercises as a common form of differentiation when working with the workbooks. There is only little foreign language material produced by the publishers to CLIL pupils and especially since written English is not yet taught in the first and second grade. The assessment of CLIL seemed more challenging and the teachers had varying methods in doing so. There was not yet a CLIL curriculum in place, but the development process was ongoing. Both teachers mainly used formative methods to evaluate the pupils. The other teacher evaluated the class as a whole and the other more individually. The main goal for assessment was to keep aware of the pupils' skill language development since no official evaluation of CLIL is given. The assessment should always support learning and the shared CLIL curriculum will probably provide more uniform methods in the future.

In conclusion, the 5D's model seems to provide a good framework to observe the different aspects of CLIL education. Teachers in a CLIL mathematics classroom are using versatile differentiation methods but might not always recognise it themselves. CLIL education can offer possibilities for teaching and learning in new ways and paired with efficient means of differentiation can create a positive change in the bigger picture.

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APPENDICES

Appendix 1. Interview outline for Teacher1.

Taustatiedot

1. Kuinka pitkään olet ollut opettajana?
2. Kuinka kauan olet antanut CLIL-opetusta?
3. Mitä luokka-astetta opetat?
4. Kuinka monta viikkotuntia opetat CLIL-opetusta?

Eriyttäminen

- Millaisia ajatuksia sinulla on eriyttämisestä?
- Millaisia eroja näet eriyttämisessä normiluokasssa ja CLIL-luokassa?
- Mikä eriyttämisessä on mielestäsi erityisen haasteellista?
- Kertoisitko minulle matematiikan opetuksessa sinun luokassasi? Millaisia ovat tavalliset matematiikan tunnit?
- Me vierailimme IKI-hankkeen kanssa viime keväänä teidän koulussa ja kuvasimme muutamia tunteja. Videoidulla tunnilla aloititte laskemalla paikalla olevat oppilaat englanniksi. Mitä muita rutiineja tai tapoja te toteutatte englanniksi?
- Paikalla oli kymmenen oppilasta. Onko teillä jakoryhmiä CLIL opetuksessa? Miten jaatte ryhmiä?
- Annatko tukiopetusta CLIL-opetukseen liittyen?
- Nyt haluaisin näyttää sinulle yhden pätkän tuosta viime keväisestä tunnista. ’’1:05-5:50’’
- Millaisia asioita otat huomioon, kun opetat ja ohjeistat CLIL oppitunteja?

- Videolla näkyy luokkahuoneesi etuosa. Miten CLIL näkyy luokkahuoneessa? Onko esim. tekstejä kohdekielellä? Entä matematiikka? Millaisia fyysiseen oppimisympäristöön liittyviä eriyttämisratkaisuja olet käyttänyt?

- Videolla näkyy toinen aikuinen luokassa. Millaisia erityisopettaja resursseja teillä on käytössä matematiikan tunneilla? Entä ohjaajia?

- Käytättekö CLIL opetuksessa yhteisopettajuutta?

- ''27:02-28:37'' Pehmolelukaupassa käytettiin numerokortteja ja leluja apuna havainnollistamissa.
  - Millaista havainnollistavaa materiaalia käytätte CLIL matematiikan tunneilla?
  - Millaista kirjallista materiaalia käytätte CLIL matematiikan tunneilla?
  - Millaisia CLIL materiaaleja käytät yleensä?

- Tällä oppitunnilla on opettajajohtoista työskentelyä. Mitä muita työtapoja käytätte CLIL matematiikassa? Millaisia eriyttämisen keinoja olet käyttänyt matematiikan tunneilla?

- Videoidulla oppitunnilla ei käytetty aktiviteeteissa lainkaan suomea. Onko se tavallista CLIL-opetuksessasi?

- ''4:30-5:29'' Tässä kohtaa vaihdoit kieltä, voisitko kertoa miksi?

- Tunnin lopussa kysyit vielä oppilailta ymmärsivätkö he tunnin opetusta. Millaisia tavoitteita asetat CLIL matematiikan tunneille? Millä tavoilla arvioit oppilaiden osaamista CLIL matematiikan tunneilla?

- Et antanut tällä tunnilla lainkaan kotiläksyjä. Saavatko oppilaat CLIL-tunneilta läksyjä? Eriytätkö kotitehtäviä?

- Väillä erilaisista työtavoista tai vaikka niistä läksyistä saattaa tulla lasten välillä kinaa. Millä keinoin opetat lapsia hyväksymään erilaisuutta ja eriyttämisen ymmärrystä?

- Tuleeko vielä mieleen muuta CLIL matematiikkaan liittyen?

Appendix 2. Interview outline for Teacher2.

Taustatiedot

1. Kuinka pitkään olet ollut opettajana?
2. Kuinka kauan olet antanut CLIL-opetusta?
3. Mitä luokka-astetta opetat?
4. Kuinka monta viikkotuntia opetat CLIL-opetusta?

Eriyttäminen

- Millaisia ajatuksia sinulla on eriyttämisestä?
- Millaisia eroja näet eriyttämisessä normiluokasssa ja CLIL-luokassa?
- Mikä eriyttämisessä on mielestäsi erityisen haasteellista?
- Kertoisitko minulle matematiikan opetuksessa sinun luokassasi? Millaisia ovat tavalliset matematiikan tunnit?
- Me vierailimme IKI-hankkeen kanssa viime keväänä teidän koulussa ja kuvasimme muutamia tunteja. Nyt haluaisin näyttää muutaman pätkän siltä tunnilta.
- ''03:38-05:25'' Tunnin alussa oppilaat siis saivat ohjeet taululle ja tekivät annettuja tehtäviä. Luokassa on yhtä aikaa aika monta aikuista. Millaisia erityisopettaja resursseja teillä on käytössä matematiikan tunneilla? Entä ohjaajia? Käytättekö CLIL opetuksessa yhteisopettajuutta?
- Videolla näyttäisi, että koko luokka on paikalla tällä tunnilla. Onko teillä jakoryhmiä CLIL opetuksessa? Miten jaatte ryhmiä?
- Annatko tukiopetusta CLIL-opetukseen liittyen?
- Videossa näkyy, kun tehtävien teko keskeytetään, noustaan seisomaan ja ohjaat lyhyen harjoituksen. Onko teillä muita rutiineja esimerkiksi tunnin aloituksissa tai lopetuksissa, joita teette CLIL tunneilla?
- Videolla näkyy luokkahuoneesi etuosa. Miten CLIL näkyy luokkahuoneessa? Onko esim. tekstejä kohdekielellä? Entä matematiikka? Millaisia fyysiseen oppimisympäristöön liittyviä eriyttämisratkaisuja olet käyttänyt?
- ''06:35-09:57'' Videolla aloitte laskea päässälaskuja ja annoit ohjeet myös suomeksi. Voisitko kertoa, miksi vaihdoit tässä kieltä? Oppilat puhuvat tunnilla sinulle suomea takaisin, onko se näin kaikilla CLIL tunneilla vai vaihteleeko se? Kun tarkastatte päässälaskut myöhemmin tunnilla teette sen kokonaan suomeksi. Kuinka paljon sinä käytät suomen kieltä CLIL-tunneilla?

- ’’10:46-12:37’’ Tässä annoit päässälaskut ensin englanniksi, sitten suomeksi ja vielä yhdelle oppilaalle erikseen suomeksi. Tämähän poikkeaa hieman tavallisesta päässälaskurutiinista, jossa ne toistetaan vain kaksi kertaa. Millaisia tavoitteita asetat CLIL matematiikan tunneille? Millä tavoilla arvioit oppilaiden osaamista CLIL matematiikan tunneilla?

- Päässälaskujen aikana annat visuaalisesti apua näyttämällä käsillä pienet ja isot naulat ja sanan pencil kohdalla näytät kynää ja teacher osoitat itseäsi. Millaisia asioita otat huomioon, kun opetat ja ohjeistat CLIL oppitunteja?

- Päässälaskujen jälkeen jatkoitte kirjan tehtävillä. Millaista kirjallista materiaalia käytätte CLIL matematiikan tunneilla? Millaista havainnollistavaa materiaalia käytätte CLIL matematiikan tunneilla? Millaisia CLIL materiaaleja käytät yleensä?

- Tällä oppitunnilla on opettajajohtoista työskentelyä. Mitä muita työtapoja käytätte CLIL matematiikassa? Millaisia eriyttämisen keinoja olet käyttänyt matematiikan tunneilla?

- Kotitehtäväksi tuli matematiikan harjoittelua. Eriytätkö läksyjä?

- Väillä erilaisista työtavoista tai vaikka niistä läksyistä saattaa tulla lasten välillä kinaa. Millä keinoin opetat lapsia hyväksymään erilaisuutta ja eriyttämisen ymmärrystä?

- Tuleeko vielä mieleen muuta CLIL matematiikkaan liittyen?

Appendix 3. The research permission for the participants.

JYVÄSKYLÄN YLIOPISTO

SUOSTUMUS TIETEELLISEEN TUTKIMUKSEEN

Minua on pyydetty osallistumaan tutkimukseen " Eriyttäminen CLIL-matematiikassa ensimmäisellä ja toisella luokalla".

Olen perehtynyt tutkimusta koskevaan tiedotteeseen (tietosuojailmoitus) ja saanut riittävästi tietoa tutkimuksesta ja sen toteuttamisesta. Tutkimuksen sisältö on kerrottu minulle ja olen saanut riittävän vastauksen kaikkiin tutkimusta koskeviin kysymyksiini. Minulla on ollut riittävästi aikaa harkita tutkimukseen osallistumista.

Ymmärrän, että tähän tutkimukseen osallistuminen on vapaaehtoista. Minulla on oikeus, milloin tahansa tutkimuksen aikana ja syytä ilmoittamatta keskeyttää tutkimukseen osallistuminen tai peruuttaa suostumukseni tutkimukseen. Tutkimuksen keskeyttämisestä tai suostumuksen peruuttamisesta ei aiheudu minulle kielteisiä seuraamuksia.

En osallistu mittauksiin flunssaisena, kuumeisena, toipilaana tai muuten huonovointisena.

Olen tutustunut tietosuojailmoituksessa kerrottuihin rekisteröidyn oikeuksiin ja rajoituksiin.

Allekirjoittamalla suostumuslomakkeen hyväksyn tietojeni käytön tietosuojailmoituksessa kuvattuun tutkimukseen.

❑ Kyllä

Annan luvan siihen, että minut saattaa tunnistaa tutkimustuloksista.
❑ Kyllä

Annan luvan siihen, että haastatteluaineistoa saa käyttää osana IKI-hankkeen tutkimusaineistoa

❑ Kyllä

Allekirjoituksellani vahvistan, että osallistun tutkimukseen ja suostun vapaaehtoisesti tutkittavaksi sekä annan luvan edellä kerrottuihin asioihin.

Y-tunnus:
02458947
Sähköposti:
etun mi.sukunim @jyu.fi

Puhelin:
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Jyväskylän yliopisto
PL 35
40014 Jyväskylän yliopisto
www.jyu.f

Tietosuoja-asetus (679/2016) 12-14, 30 artikla

JYVÄSKYLÄN YLIOPISTO

TIETOSUOJAILMOITUS TUTKIMUKSESTA TUTKIMUKSEEN OSALLISTUVALLE

12.02.2019

1. TUTKIMUKSEN NIMI, LUONNE JA KESTO

Innovatiivisen kielikasvatuksen kartta ja kompassi – IKI

8/2018- 7/2021

2. MIHIN HENKILÖTIETOJEN KÄSITTELY PERUSTUU

EU:n yleinen tietosuoja-asetus, artikla 6, kohta 1

☒ rekisteröidyn suostumus

3. TUTKIMUKSESTA VASTAAVAT TAHOT

Rekisterinpitäjä: Jyväskylän yliopisto, Seminaarinkatu 15, PL 35, 40014 Jyväskylän yliopisto. Vaihde (014) 260 1211, Y-tunnus 0245894-7. **Jyväskylän yliopiston tietosuojavastaava:** tietosuoja@jyu.fi**, puh. 040 805 3297.** Rekisterinpitäjä voi olla myös yksittäinen tutkija.

Lisätietoja tutkimuksen toteuttajista liitteessä 1.

4. TUTKIMUKSEN TAVOITE JA KERÄTTÄVÄT HENKILÖTIEDOT

Tämän tutkimuksen tavoitteena on kartoittaa ja kehittää kielikasvatuksen innovaatioita sekä olosuhteita suomalaisessa varhaiskasvatuksessa ja perusopetuksessa. Kriittisen tarkastelun avulla tunnistetaan eri käytänteiden ja innovaatioiden hyödyt erilaisissa konteksteissa ja yhteisöissä sekä jaetaan eteenpäin toimivia innovaatioita ja niihin käytettyä materiaalia.

Aineistoa kerätään päiväkodeista, esiopetusryhmistä ja peruskouluista, jotka haluavat jakaa innovaationsa.

Käsiteltävät henkilötiedot

Hankkeessa käsitellään koulujen, päiväkotien, opettajien ja varhaiskasvattajien yhteystietoja, haastatteluvastauksia, havainnointimuistiinpanoja, valoku-

Appendix 4. The data storage agreement.

via toimitiloista ja materiaaleista. Lisäksi hankkeessa käsitellään videoaineistoja niistä päiväkodeista ja kouluista, joihin videointilupa on saatu. Videoissa voi joissain tapauksissa käydä ilmi myös erityisiin henkilötietoryhmiin kuuluvia tietoja. Opettajien ja varhaiskasvattajien haastattelut tallennetaan sopimuksen mukaan ääni- tai videotiedostoina. Näitä analysoimalla laaditaan kirjalliset kuvaukset innovaatioista, jotka jaetaan julkisesti hankkeen nettisivuilla. Kartoitettuihin toimintamalleihin liittyvää materiaalia jaetaan eteenpäin julkisesti, niissä tapauksissa, joissa opettajat/varhaiskasvattajat haluavat jakaa itse kehittämäänsä materiaalia myös muille kiinnostuneille.

Tutkimukseen osallistuvilta ammattilaisilta ja yhteisöiltä pyydetään lupa kirjallisten kuvausten ja otettujen valokuvien jakamiseen julkisesti. Ennen julkista jakamista kirjallisista kuvauksista ja valokuvista poistetaan ilmeisiä tunnistetietoja. Tutkimuslupia pyydettäessä osallistujia kuitenkin informoidaan siitä, että hanke ei voi taata täyttä anonymiteettiä, sillä innovaatioiden kirjallisten kuvausten julkinen jakaminen voi tietyissä tapauksissa (esim. harvinainen innovaatio tai konteksti) mahdollistaa yksittäisen ammattilaisen tai yhteisön tunnistamisen. Lisäksi, jos opettajat, varhaiskasvattajat, koulut tai päiväkodit haluavat, on mahdollista säilyttää yksilölliset tiedot, jolloin innovaation jakamisen yhteydessä mainitaan innovaatiota/toimintamallia kehittänyt ammattilainen ja/tai yhteisö. Julkisesti ei kuitenkaan missään tapauksissa jaeta lasten suoria tunnistetietoja. Videoaineisto on sellaisenaan ainoastaan tutkimusryhmän käytössä, eikä sitä ole tarkoitus julkaista. Myöskään opettajien haastatteluja ei julkaista. Valokuvia materiaalista ja opetustiloista käsitellään ennen julkaisua niin, ettei niissä ole tunnistetietoja. Haastatteluiden ja videoaineistojen litteroinneista sekä havainnointimuistiinpanoista voidaan julkaisuissa käyttää suoria lainauksia, sen jälkeen, kun ilmeiset tunnistetiedot on poistettu.

5. TUTKIMUKSEN TOTEUTTAMINEN KÄYTÄNNÖSSÄ

Aineistoa kerätään päiväkodeista, esiopetusryhmistä ja peruskouluista, jotka haluavat jakaa innovaationsa. Aineistoa kerätään helmikuun 2019 puolivälistä alkaen hankkeen loppuun asti. Tutkimuksessa havainnoidaan koulun, päiväkodin, opettajan tai muun ammattilaisen käytänteitä ja toimintatapoja tavallisen toiminnan ohessa. Havainnoinneissa keskitytään opettajan/ varhaiskasvattajan toimintaan ja vuorovaikutukseen lasten/nuorten kanssa.

Aineistoa kerätään tutkimuslupien mukaisesti havainnoimalla innovaatioita sekä haastattelemalla opettajia ja varhaiskasvattaja. Havainnoinneissa hyödynnetään hankkeen työntekijöiden tekemää havainnointirunkoa, johon kirjataan muistiinpanoja havainnoinnista. Lisäksi opetustunteja, tuokioita ja arjen tilanteita videoidaan, niissä tapauksissa, joissa kuvauslupa on saatu. Opetustiloista ja ammattilaisten käyttämistä materiaaleista otetaan valokuvia.

Haastatteluin ja keskusteluin kartoitetaan niiden opettajien, varhaiskasvattajien ja opettajaopiskelijoiden kokemuksia, jotka haluavat kertoa tarkemmin kehitettyjen toimintatapojen toimivuudesta ja sekä omien pedagogisten käytänteiden että yhteisöjen työtapojen kehittymisestä. Haastattelut äänitetään tai videoidaan, sen mukaan mitä on sovittu osallistujan kanssa. Haastatteluaineisto litteroidaan. Litteraatista voidaan julkaista suoria lainauksia hankkeen tavoitteiden mukaan.

Tutkimuksessa havainnoidaan koulun/päiväkodin tavanomaista toimintaa, eikä se näin ollen vaadi erityistä valmistautumista tutkimukseen osallistujilta. Tutkimuksessa tapahtuvat havainnoinnit kestävät havainnointikohteesta riippuen yhdestä opetustuokiosta yhteen viikkoon. Jokaisen tutkimukseen osallistuvan yksikön henkilökunnan kanssa sovitaan erikseen havainnointien ajankohdat ja kestot. Tutkittavia informoidaan havainnointien kestosta ja ajankohdista erikseen.

Tutkimukseen osallistumiseen ei liity psyykkisiä tai fyysisiä haittoja ja riskejä osallistujille.

6. TUTKIMUKSEN MAHDOLLISET HYÖDYT JA HAITAT TUTKITTAVILLE

Tutkimus tuottaa tietoa innovatiivisista kielikasvatuksen käytännöistä, toimintatavoista ja olosuhteista eri puolilta Suomea sekä niiden kehittämisestä.

Opettajat, varhaiskasvattajat, koulut ja päiväkodit saavat tietoa ajankohtaisista kielikasvatuksen innovaatioista, ja voivat halutessaan hyödyntää saamaansa tietoa ja materiaalia oman toimintansa kehittämiseen. Lisäksi hankkeeseen osallistuminen antaa mahdollisuuden verkostoitumiseen tutkimukseen osallistuvien asiantuntijaryhmien kesken.

Tutkimukseen osallistumisesta ei aiheudu haittaa osallistujille.

7. HENKILÖTIETOJEN SUOJAAMINEN

Tutkimuksessa kerättyjä tietoja ja tutkimustuloksia käsitellään luottamuksellisesti tietosuojalainsäädännön edellyttämällä tavalla. Ammattilaisten ja yhteisöjen suorat tunnistetiedot kuten nimet tai paikannimet) häivytetään julkaistavista tiedoista, ellei siihen olla annettu nimenomaista suostumusta tunnistetietojen käyttämiseen.

Tutkimuslupia pyydettäessä osallistujia kuitenkin informoidaan siitä, että hanke ei voi taata täyttä anonymiteettiä, sillä innovaatioiden julkinen jakaminen voi tietyissä tapauksissa (esim. harvinainen innovaatio tai konteksti) mahdollistaa tunnistamisen. Julkaisuissa käytetään myös suoria lainauksia, pyrkien kuitenkin varmistamaan, etteivät osallistuvat ammattilaiset

ole helposti tunnistettavissa, elleivät he sitä itse halua. Lisäksi, jos ammattilaiset ja yhteisöt haluavat, on mahdollista säilyttää yksilölliset tiedot, jolloin innovaation jakamisen yhteydessä mainitaan innovaatiota/toimintamallia kehittänyt ammattilainen ja/tai yhteisö. **Julkisesti ei kuitenkaan missään tapauksissa jaeta lasten suoria tunnistetietoja.**

Kartoitettujen toimintamallien kuvauksia jaetaan eteenpäin julkisesti (esim. projektin kotisivujen ja muiden sopivien väylien kautta), niissä tapauksissa, joissa opettajat haluavat jakaa kehittämiään toimintamalleja ja niiden käyttöön tarvittavaa materiaalia myös muille kiinnostuneille.

Henkilötietojen suojaamiseksi käytetään seuraavia suojatoimia (valitse yksi tai useita/poista ne joita ei käytetä)

- tutkimuksella on vastuullinen johtaja tai siitä vastaava ryhmä;
- henkilörekisterin käyttö perustuu asianmukaiseen tutkimussuunnitelmaan
- henkilörekisteriä käytetään vain historiallista tai tieteellistä tutkimusta varten
- henkilörekisteri hävitetään tai siirretään arkistoitavaksi tai sen tiedot muutetaan sellaiseen muotoon, ettei tiedon kohde ole niistä tunnistettavissa, kun henkilötiedot eivät enää ole tarpeen tutkimuksen suorittamiseksi tai sen tulosten asianmukaisuuden varmistamiseksi.
- rekisterinpitäjän ja käsittelijän sisäiset toimenpiteet, joilla estetään pääsy henkilötietoihin;
- henkilötietojen pseudonymisointi;
- tietoturvalliset henkilötietojen käsittely-ympäristöt;
- muut organisatoriset toimenpiteet (kuten koulutus ja sopimukset tutkimusavustajien kanssa)

Suorien tunnistetietojen käsittely:

- Suoria tunnisteita ei poisteta analysointivaiheessa videoaineiston osalta. Videonauhoitukset ovat vain tutkimusryhmän käytössä.

Tutkimustuloksissa ja muissa asiakirjoissa yhteisöihin ja ammattilaisiin viitataan vain tunnistekoodilla, ellei ole annettu nimenomaista suostumusta käyttää ammattilaisen tai yhteisön nimeä tunnistekoodin sijaan. Tunnistekoodiavainta, joka mahdollistaa henkilötietojenne yhdistämisen tunnistekoodeihin säilytetään tietoturvallisesti, ja anonymisoitu osa aineistosta arkistoidaan

hankkeen päätyttyä tutkijoiden käyttämään tietokantaan (esim. Avoimen tiedon keskus).

Tutkimusaineistoa säilytetään Jyväskylän yliopiston tutkimusaineiston käsittelyä koskevien tietoturvakäytänteiden mukaisesti.

8. TUTKIMUSTULOKSET

Tutkimuksessa valmistuu tieteellisiä julkaisuja, opinnäytetöitä, kongressi- ja seminaariesityksiä, opetusta ja täydennyskoulutusta, käytännön sovelluksia, raportteja ja opetus- ja koulutusmateriaalia.

Tuloksia ja materiaaleja jaetaan julkisesti hankkeen eri kanavien kautta. Tiedot kanavista jaetaan tutkimukseen osallistuviin yksiköihin.

9. TUTKIMUKSEN KUSTANNUKSET JA TALOUDELLISET SELVITYKSET

Tutkimukseen osallistumisesta ei aiheudu sinulle kustannuksia.

Tutkimuksen rahoituksesta vastaa Opetus- ja kulttuuriministeriö.

10. TUTKITTAVAN OIKEUDET JA NIISTÄ POIKKEAMINEN

Tutkittavalla on oikeus peruuttaa antamansa suostumus, mikäli henkilötietojen käsittely perustuu suostumukseen.

Tutkittavalla on oikeus tehdä valitus Tietosuojavaltuutetun toimistoon, mikäli tutkittava katsoo, että häntä koskevien henkilötietojen käsittelyssä on rikottu voimassa olevaa tietosuojalainsäädäntöä. (lue lisää: http://www.tietosuoja.fi).

Lisätietoa tutkittavan oikeuksista:https://www.jyu.fi/fi/yliopisto/tietosuojailmoitus/rekisteroidyn-oikeudet

Rekisteröidyn EU:n yleisen tietosuoja-asetuksen mukaisista oikeuksista voidaan ***tarvittaessa*** poiketa, jos oikeuksia rajoitetaan kansallisessa lainsäädännössä (HE 9/2018 vp), tieteellisessä tutkimuksessa seuraavin suojatoimin, jos se on tarpeellista:

1.Henkilötietojen käsittely perustuu tutkimussuunnitelmaan.

2.Tutkimuksella on vastuuhenkilö tai siitä vastaava ryhmä.

3.Henkilötietoja käytetään ja luovutetaan vain historiallista tai tieteellistä tutkimusta taikka muuta yhteensopivaa tarkoitusta (tilastointi) varten sekä muutoinkin toimitaan niin, että tiettyä henkilöä koskevat tiedot eivät paljastu ulkopuolisille.

4.Lainsäädännön niin edellytettäessä on laadittu vaikutustenarviointi.

Poikkeaminen rekisteröidyn oikeuksista on mahdollista ainoastaan siltä osin kuin edellä kerrotut oikeudet todennäköisesti estävät tai vaikeuttavat suuresti tutkimuksen tarkoitusten saavuttamisen. Esimerkiksi tilanteessa, jossa tutkimusaineisto on täysin pseudonymisoitu tai anonymisoitu eikä rekisterinpitäjällä ole koodiavainta hallussaan, voisi rekisteröidyn tarkastusoikeuden käyttäminen vaikeuttaa tutkimuksen tekemistä suuresti.

Seuraavista rekisteröidyn EU:n yleisen tietosuoja-asetuksen mukaisista oikeuksista poiketaan tässä tutkimuksessa:

☒ Rekisteröidyn oikeus tietojensa poistamiseen (artikla 17). Oikeus todennäköisesti estäisi tieteellisen tutkimuksen tai vaikeuttaisi sitä suuresti.

Perustelu oikeuksista poikkeamiselle: Tietoja voidaan keräämisvaiheessa korjata, mutta koska osasta aineistoa poistetaan kaikki suorat tunnistetiedot analysointivaiheessa, tutkittavien tunnistaminen ei ole mahdollista tutkimuksen aikana.

11. HENKILÖTIETOJEN SÄILYTTÄMINEN JA ARKISTOINTI

Säilyttäminen

Rekisteriä säilytetään salasanasuojattuna yliopiston käyttämillä suojatuilla ja varmuuskopioiduilla alustoilla hankkeen ajan. Videoaineistoa säilytetään tunnisteellisena tutkimusryhmän käytössä. Muuta aineistoa säilytetään pseudonymisoituna, minkä jälkeen aineisto arkistoidaan.

Arkistointi

Arkistointi tapahtuu sen jälkeen, kun hankkeeseen liittyneet tutkimukset ovat päättyneet, eikä aineistoa enää käytetä alkuperäiseen tarkoitukseen. Tutkimusaineistoa on tarkoitus hyödyntää myös myöhemmissä tutkimuksissa ja osallistujia on informoitu siitä suostumuksen pyytämisen yhteydessä. Alkuperäiset videot ja muokkaamattomat valokuvat hävitetään hankkeeseen liittyvien tutkimusten päätyttyä. Editoidut videot säilytetään opetuskäytössä.

Anonymisoitu osa tutkimusaineistosta arkistoidaan tutkimuksen päätyttyä pysyvästi Avoimen tiedon keskukseen (https://openscience.jyu.fi/fi).

12. REKISTERÖIDYN OIKEUKSIEN TOTEUTTAMINEN

Jos sinulla on kysyttävää rekisteröidyn oikeuksista, voit olla yhteydessä yliopiston tietosuojavastaavaan. Kaikki oikeuksien toteuttamista koskevat pyynnöt toimitetaan Jyväskylän yliopiston kirjaamoon. Kirjaamo ja arkisto, PL 35 (C), 40014 Jyväskylän yliopisto, puh. 040 805 3472, e-mail: kirjaamo(at)jyu.fi. Käyntiosoite: Seminaarinkatu 15 C-rakennus (Yliopiston päärakennus, 1. krs), huone C 140.

13. TUTKITTAVIEN VAKUUTUSTURVA

Jyväskylän yliopiston henkilökunta ja toiminta on vakuutettu. Vakuutus sisältää potilasvakuutuksen, toiminnanvastuuvakuutuksen ja vapaaehtoisen tapaturmavakuutuksen.

Liite 1: Tutkimuksen vastaavat tahot ja yhteyshenkilöt

Tutkimuksen vastuullinen johtaja: Josephine Moate, +358408053350, josephine.m.moate@jyu.fi, Ruusupuisto, RUU-Rakennus, Alvar Aallon katu 9, 40014 JYVÄSKYLÄN YLIOPISTO

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Tutkimuksen suorittajat: Henkilötietoja käsittelevät ovat sopimussuhteessa yliopistoon (mukana on työntekijöitä opettajankoulutuslaitokselta, kasvatustieteiden laitokselta ja kieli- ja viestintätieteiden laitokselta). Lisäksi hankkeessa ovat mukana Åbo Akademin Vaasan yksikkö ja Turun yliopiston Rauman opettajankoulutuslaitos. Lisätietoja henkilöistä saa tutkimuksen johtajalta.

Henkilötietojen luovuttaminen:

Hankkeen tarkoituksena on yhteistyössä kartoittaa, tarkastella ja kehittää innovaatioita. Åbo akademi ja Turun yliopisto toimivat mahdollisina partnereina henkilötietoja sisältävän aineiston käsittelyssä. Tietoja voidaan luovuttaa tutkimusyhteistyökumppaneille alkuperäistä tarkoitusta varten. Siinäkin tapauksessa kaikkia osapuolia sitovat salassapitovelvollisuudet. Tiedot luovutetaan osittain koodattuina, jotta partneriyliopistot voivat osallistua aineiston analysointiin ja hankkeeseen liittyvään tutkimus- ja kehitystyöhön.

Tutkimuksen rekisterinpitäjä on Jyväskylän yliopisto. Osa tutkimusaineistosta on partneriyliopistojen käytössä. Anonymisoitu osa aineistosta arkistoidaan hankkeeseen liittyvien tutkimusten päätyttyä Avoimen tiedon keskukseen (https://openscience.jyu.fi/fi).

Rekisterinpitäjällä on tietojenkäsittelysopimus Åbo akademin ja Turun yliopiston kanssa.

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