

The use of multiple languages when teaching mathematics in reception classes and adult education schools in Norway

A qualitative study on the usage of languages when teaching mathematics in reception and adult education schools in Norway

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Lektorutdanning i realfag

30 studiepoeng

Institutt for pedagogikk

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Summary

In a world where speaking multiple languages is the norm and where multitudes of cultures and ethnicities flourish, the society has gotten to a level where it is normal to speak a language while living in another country. With the presence of an abundant number of languages, there arises a wide spectrum of skills within those languages. When these individuals move to a new country their learning is heavily impacted by how schools and teaching institutions prepare them for the road after the introductory classes. It is the teacher's role to prepare lessons and teach in ways that help achieve the best learning outcomes for those who know don't know enough or are struggling with languages.

To study the effect that the multitude of languages has on mathematics education in the Norwegian context it was needed to interview teachers from the different sectors in the education scene. The purpose of the interview is to staple an insight on what effects would mathematics teaching have on immigrant learners who have a first language other than Norwegian and whether their language can be capitalised upon and skilfully utilized to help them acquire the subject of mathematics in its depth.

The research carried out through this paper was done on three multilingual teachers working with newly arrived individuals in Norway. One teacher working in adult education schools and two working in reception classes in two lower secondary schools in Oslo. The data gathered from those teachers was through semi-structured interviews in order to answer the following thesis question:

What learning methods do mathematics teachers use with immigrant pupils in both reception and adult education classes with a first language other than Norwegian and can the students' first language be utilized to help them better learn the subject.

The purpose of the interviews is to find out the teachers' methods the teachers use when teaching mathematics and how they would impellent the students' first languages to help them learn mathematics better. What have been acquired is that these teachers have to make adaptations to the lesson planning and when teaching, they use more representations for better learning mainly visual representations. These teachers tend to depend on translations between the students' first languages and Norwegian and lastly, they aim to build a proper subject-specific language in the subject using glossaries and definitions of terms. In the interviews,

the teachers' have also been asked about the challenges that they were met with. Those challenges can be comprised of time management, the resources available, class size and class composition and lastly what expectations they have to manage.

The aim of this research paper is to find out and present what teaching methods some teachers in reception classes and adult education schools use with their students dependent on their linguistic needs and academic levels. This project wants to raise awareness of and reflect on the nature of some of the situations in these classes.

Preface and acknowledgments

In July 2013, I moved to Norway with my family and started my educational journey in a reception class in Oslo. During that year I was lucky to have a mathematics teacher who taught in English and Norwegian. Most of the time he was teaching in English which was the main language I got my mathematical knowledge through back in my previous school in Lebanon. That is why the topics introduced did not feel new nor did they feel difficult, but the others in that class were not as lucky as me because they did not know English and it was clear that they had some hardships when learning. Those memories from learning in that reception class have continued to motivate me to one day end up working in similar classes. My love and curiosity for the subject of mathematics have grown throughout the years great enough for me to want a career in teaching it.

Per this submission it is exactly 10 since I opened this new chapter of my life in Norway. The idea behind this project was a natural consequence to that experience in my lifetime. I have always been curious if my experience in reception class would have taken a turn had I neither been able to speak English nor learn mathematics through it. It is clear that this is where the inspiration of writing this thesis came from. Leading to me, 10 years later, handing in my masters on the use of multiple languages when teaching mathematics in these types of classes.

I would like to thank all the experiences that have shaped me to be the teacher I am today, and my family for supporting me through my educational journey. A special thanks is due for my amazing mother for her support through sleepless nights and times I worried I will not be able to finish this masters. Another thank for my best friend Vageeha for proofreading my documents even if I send them in the latest hours of the nights. Lastly, I thank my supervisor Helmer Aslaksen for his support this semester.

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1 Introduction

In August 2017 I started my journey in studying mathematics and science to get a master's degree in education through lektorprogrammet in the University of Oslo. Currently, in 2023 I am at my major and most important assignment waiting to be handed in, which is writing my master's degree. The theme of this paper is a reflection of my years of education and experiences as a student and teacher. This degree carries as well the weight of all my past and present experiences as an individual being part of a society where I use a language in my daily life at home and another for studying and working. The aspect of being multilingual has always been an interesting part of my life because every language that I have learned has had an impact on how comfortable I am in receiving education in that language. Growing up in Lebanon, Arabic was my mother tongue, the first language I learned to form my words and the one I would express my thoughts through. Then came English, the language I received my education, in all the science subjects including maths. Norwegian was the last of them, I learned it due to moving to Norway in August 2013, I went to a reception class in Oslo that marked the start of that learning journey.

After a year in reception class, I went to a Norwegian high school and from there got all my education in Norwegian. This resulted in Arabic being the language I think in and the one I find most comfort in speaking, and when it comes to acquiring knowledge in the field of science it is undoubtedly only English and Norwegian, I know I can heavily rely on. The same can be said when it came to mathematics because, during my study at university, I got my formal education in both Norwegian and English. A few years after I started university I began teaching at a lower secondary school in Oslo, I taught students between the ages of 13 and 16 both science and math. These students belonged to a multitude of different ethnicities and spoke on average of 2 to 3 languages each.

In my 4 years of experience teaching mathematics in Norwegian schools, I have observed that children with first languages other than Norwegian are more prone to struggle to express themselves fully in the subject of mathematics. Leading on from this observation it was of great interest for me to investigate the reasons behind the struggle that those children are facing. Therefore, after being moulded by these experiences I found it only natural to investigate what learning processes or methods that have been used from when those children first started to learn mathematics in Norwegian that have had an impact on their learning.

The idea here is to study the learning methods that teachers use in the beginning phases of learning mathematics in Norwegian and how we as teachers can help them understand and learn mathematics better by utilizing their first language in those classrooms. With this research, I will be looking at teaching methods as ways to prevent or lessen the struggle that these bilingual students face when learning mathematics. These students should be able to understand mathematics and be able to express their thought processes and arguments in the subject in a language that is not their first.

According to the Ministry of Education, it is expected that all students are to receive an offer of education that is adapted to their abilities and precondition (regjering.no). Adapting to students' abilities and those preconditions do not solely imply an adjustment on the levels of difficulty or complexity of exercises. These adjustments should also extend to provide assistance on the language levels for anyone receiving any form of education. This is especially important if the end goal is that these students, who are newly learning Norwegian, reach the same level of academic concept understanding as their fellow peers.

Therefore, the thesis question that I will base my master's project on is as follows:

"What learning methods do mathematics teachers use with immigrant pupils in both reception and adult education classes with a first language other than Norwegian and can the students' first language be utilized to help them better learn the subject?"

Here, as it is stated in my thesis question, I will focus of this research will be limited to learning processes and methods used by teachers in reception classes and adult education schools, although those are not the only sectors of education that provide linguistic assistance to pupils.

An interesting aspect related to this topic of research is to check if these same methods, discussed in the results, can be used with immigrant students in ordinary classes, the ones that can speak Norwegian but still not on the same level as their peers. Though this is a topic of great interest and relation to the theme of linguistic assistance, it will not be discussed in this paper and will rather be left as a prompt for further research. The sides that will actually be studied are the methods of teaching the teachers use and how teachers capitalize on the students first languages to promote their learning. Here, the aim is to find out how the teachers in the selection of this research use the multitude of languages available in those students when teaching the subject of mathematics, so that the students acquire the subject in

the best ways possible. A part of this thesis is to also get a deeper understanding of how the teacher can guide students through hinders created by language barriers to a clearer understanding of the mathematical processes and concepts using different languages.

What is of interest to find out from this thesis is if utilizing methods when teaching newcomers to Norway mathematics in Norwegian with the help of their first language would make their transition into ordinary Norwegian classrooms and society easier. In this learning journey, the starting point would have to be the students' previous concept knowledge and first language, and the endpoint would be a more progressed and richer concept knowledge. This richer concept knowledge should also include the student's ability to articulate and express arguments and calculations comfortably in Norwegian. It is interesting to investigate whether the receiver of such education will be able to smoothly transition into higher forms of education and better assimilation into Norwegian society.

This master's project will be limited to only studying the use of different languages in mathematics lessons from the perspective of the teachers and the methods that they use. Another project that can be carried out as an extension to this, would be by studying the effects multilingual mathematics education has on students, this study would reflect the learning experience from the perspective of the students. This would be a natural direction of research since after leaving reception classes and adult education schools the pupils are expected to adapt to and work by different levels of cognitive demand in Norwegian society. Typical environments of learning norms that these students are going to find themselves in, if they are to continue receiving education, will have a learning level set by their peers who had received a somewhat closer education in their Norwegian schools.

1.1 Previous knowledge on the relation between languages, culture and mathematics

1.1.1 Languages, Societies and Mathematics

It has always been thought that mathematics is a neutral subject that is not influenced by the cultures of the countries the subject is taught in, but research shows that mathematics is impacted by cultural influences and historical differences of each country. Historically speaking, countries had different uses for and needs of mathematics, and naturally these types

of calculations have had their impact on how mathematics is approached and taught in our modern societies.

“We know that Greek mathematics had a very different approach from Roman mathematics (...) Mathematics in China was (therefore) utilitarian, its social origins bound up with the problems that the ruling officials had to solve ... This does not mean that Chinese calculators were not interested in truth, but it was not that abstract systematised academic truth which the Greek sought”. (Bishop, 1991, page 82)

Modern society is dominated by citizens who can speak two or more languages, the formal term for these individuals is “bilinguals”. To fully understand the word’s true meaning, definitions of this concept will be examined. Starting from Moschkovkovich & Nilson-Barber (2009) narration of what bilingualism is, their theory implies that the concept of being bilingual can not only be studied on an individual level but rather as a bigger social phenomenon. “Bilingualism is not an individual but also a social and cultural phenomenon involving participation in language practices and communities” (Moschkovkovich & Nilson-Barber, 2009, page 122). This definition used is of a diverse and inclusive nature to the previously used definition by De Avila & Duncan definition from 1981. De Avila & Duncan’s definition indicated that bilingualism is a range of fluency in two languages and the individual’s ability to switch between using those two languages. Evolving from that theory, Moschkovkovich & Nilson-Barber (2009), had added the portion on communities, culture, and social belonging to the definition thus adding a new layer of depth to the term.

Even earlier than 1981 Valides-Fallis in 1978 had defined that bilingualism involves a person who belongs to a community that speaks multiple languages. Here it is clear that in Moschkovkovich & Nilson-Barber (2009) and Valides-Fallis (1978) there is the aspect of belonging to communities and how the culture has a meaning on making languages. This indicates that there is a deeper resonance with languages that can sit deeper in bilingual individuals in regard to their cultural belonging, and subsequently their learning.

Most countries teach mathematics in their official language(s) and that leads these/this language(s) to become the student’s first language in learning. When working to understand the effects of languages and how to effectively use them, it is important to distinguish a clear difference between first language and mother tongue and what characterises each of the two terms. Daria Mizza (2014) has used both expressions to indicate the child’s native first

language that they acquired which is the same as the kid's parents. Whereas some other explanations regard mother tongue, on larger spectra, as the language of the individual's ethnic group. According to Store Norske Leksikon the term "førstespråk" is regarded as better description to be used when talking about the language children primarily had learned to speak. From this definition is to be understood that children do not necessarily acquire their parents' language as their own first language of speech.

Alongside mother tongue and first language, there is the term official language that refers to "the language or one of the languages that is accepted by a country's government, is taught in schools, used in the courts of law, etc." (Cambridge Dictionary). Another type of languages that also can have effect on the learning outcomes for students that is "school language" in Norwegian is "skolespråk". In some countries not all official languages are languages that are acknowledged by the state are the first languages of the students. This forces the students to learn through a new language that they do not speak at home, but this practice usually begins from a young age back when the student starts going to school.

Collier (1995) explained how the older the student gets and rises in grades the "academic work dramatically expands the vocabulary, sociolinguistic, and discourse dimensions of language to higher cognitive levels." (Collier, 1995, page 3). In this article, Collier (1995) explained that the most efficient way for students to learning academic concepts is by learning it from their first language to their second language. This Collier explained should be done "while teaching the second language during other periods of the school day through meaningful academic content." (Collier, 1995, page 3).

1.1.2 Mathematics through multilingual education in Norway

In Norway, the most common place for students to learn languages is through introductory classes, either via reception classes (mottaksklasser) if the student is younger than 16 years of age or through adult education classes (voksenopplæring skoler) if they are older. There, professional mother tongue teachers are central leaders for these students' most important transition from introductory classes to being taught in ordinary Norwegian classes. In Norwegian these teachers are called "morsmåslærer" or "tospråklærere" which translates to "mother tongue teachers" and "bilingual teachers" respectively. For many pupils, the first meeting with learning mathematics in the Norwegian context will be in reception classes or in adult education schools.

In a series of official documents related to Norway's public investigations (NOU) it is stated that newcomers in reception classes in Norway are to be given education in the same subjects as others of their peers. The goal here is to get these newcomers at the same level of education as others of their peers are getting.

“ I innføringsklassen skal det være fokus på norsk, men også gis opplæring i de aktuelle fag som gis de andre elevene på samme alderstrinn. Desto senere i skoleløpet eleven kommer til Norge, desto viktigere vil det være at eleven gis opplæring i grunnleggende ferdigheter i de sentrale fag etter Læreplanverket for Kunnskapsløftet. ” (NOU 2010: 7)

This sets the focus on the knowledge that the students are receiving and from a researcher's point of view, this proclamation provides bases to indulge in a deeper understanding of what is explicitly expected of the learners to know and become better at. Research should not only be an evaluation of the knowledge the students gain from the teaching, but rather should also include a study on the teachers' methods and practices. Eventually also a study on how these methods and practices should be adequate to help learners progress in their learning journey.

In the Norwegian curriculum, schools and teachers are expected to prepare and guide learners through 5 important competencies that will be important tools for them in learning and understanding subjects in any educational context. These 5 competencies can be located thoroughly explained on the webpage of the Directory of Education (Utdanningsdirektoratet) that are important for each subject taught in school. These 5 competencies or basic skills (grunnleggende ferdigheter) in mathematics are as follows: oral skills, writing, reading, numeracy, and digital skills. Numeracy is explained as “using mathematical representations, concepts and approaches to do calculations and evaluate whether solutions are valid.” (Kunnskapsdepartementet, 2017, Grunnleggende ferdigheter).

This skill is crucial for a rightful understanding of and participation in society and the making of a citizen with adequate numeracy knowledge to partake in a globalised society. According to the Directory of Education, the need to achieve this goal lays a great responsibility on both schools and educators teaching mathematics. Lynn Arthur Steen (2001) elaborated on the difference between numeracy and mathematics, but rather than condoning the two concepts as

separate he explained how educators are responsible for teaching the former through the latter.

“Mathematics is abstract and Platonic, offering absolute truths about relations among ideal objects. Numeracy is concrete and contextual, offering contingent solutions to problems about real situations. Whereas mathematics asks students to rise above context, quantitative literacy is anchored in the messy context of real life. Truly, today’s students need both mathematics and numeracy.” (Steen, 2001, s.11)

Here Steen (2001) had mentioned “quantitative literacy”, this form of literacy will be discussed in more detail in the theoretical background of this study alongside other matters regarding mathematical knowledge within students. In many works of research such as Lunde (2005), it is stated that teachers should be starting the learning journey of the student with subject concepts that the students know best and then gradually provide and employ new rules. The hypothesis is that the gradual introduction of concept topics and their respective terms to the students, ei going from “the known to the unknown”, will be greatly beneficial for them when learning new subject topics. This will make it easier for both the teacher and the student to transition from learning on shallow levels in a topic to getting deeper insights and explanations on the topics taught.

A study that Collier (1995) carried out on the amount of adaptation that students needed to receive in a subject to be on the same academic level as their peers showed significant results related to their academic background on that subject. Collier’s 1995 study had a selection of students from different backgrounds with the grades being all the way from first grade and through high school. This study showed that non-native students in the early years of schooling, typically as early as kindergarten through second or third grade, do well if they get schooling in the second language. This result contrasts with the results received for students in higher grades than those mentioned above. Collier (1995) explained that students from fourth grade through middle school and high school do less and less well as they move into higher grades. These results were reasoned to be caused by the rapid increase of the cognitive demands that the curriculum imposes on the student without the students being able to catch up as fast. This makes it harder for those multilingual students of non-native origins to catch up on both the language and academic content understanding.

Nation (2003) explains that L2, second language, proficiency can be related to first language, L1, use, “There is thus a useful role for the L1 in helping learners gain the knowledge needed to reach a higher level of L2 performance.” (Nation, 2003, page 3). Though it is an interesting topic of research to study the processes that are involved in the students learning second languages through their first, I am more interested in the students obtaining mathematical knowledge in a second language using their first language. To serve the purpose of answering the thesis question, this paper will be limited only to the importance of building an understanding of mathematics in a second language through the students’ first. Therefore the focus point of this study will only be on studying the teachers who teach multilingual students and the methods they use to help them gain knowledge in the subject of mathematics.

2 Theoretical standpoint

If students are receiving education in a language that they do not master then they might not acquire the knowledge being taught and can thus develop learning difficulties in said subject, in mathematics these learning difficulties mean that pupils develop dyscalculia. In Olav Lunde's article about minority language pupils and the difficulties that they face learning mathematics at schools, he discussed that the predominant reason for those difficulties is language-related. Lunde (2005) explained that minority language children can end up lacking in subject content knowledge either via that they do not have a full understanding of the language used in the exercise text or the pupil could not fully grasp the formula taught in class. Lunde (2005) elaborated further that this could be because they did not understand the teacher during the explanation in the classroom leading to the students getting diagnosed with learning difficulties in mathematics (s. 12)

Contrary to previous thoughts on languages and new language learning mentioned in a study by De Angelis referred to in Burner & Carlsen (2022). The teachers in De Angelis's study from 2011 believed that the brain is a container that has a limited storage space and learning one language at a time is most efficient. Burner & Carlsen (2022) stated in reference to Hélot (2015) that "a significant number of them (the teachers) believe that possessing skills in prior languages is not an asset and that the use of the L1 when learning the language of instruction is counter-productive (cf. Hélot, 2015)." (Burner & Carlsen, 2022, page 5). Compared to what is currently believed about acquired knowledge, those teachers believed that if the learner is a master of more than one language their possibility to learn others could decline.

Many researchers within pedagogy as Cummins tried to debunk such a mindset as earlier as 1984. Cummins believed that we must look at the child's overall competency regardless of how many languages they know, meaning that learners can also acquire and build knowledge via multiple languages. In a continuation to that, Lunde stated that "Man tilegner seg av nye kunnskaper og ferdigheter på et språk vil kunne overføres til et nytt språk etter hvert som en lærer å mestre det nye språket." (Lunde, 2005, s. 13). This is about students having greater competencies than what they can express, and thus it is important that we as teachers can assist them based on their overall knowledge and competencies rather than just looking at what they have expressed and produced in Norwegian. An example of a newer theory on teaching multilingual students is Cummins' (2016) "multilingual lens".

Pupils who have recently moved to Norway will perceive the change of countries as an abrupt transition from one reality to another. They will experience everything they know and have learned from before from a different point of view while experiencing and learning new things. If this transition is not made correctly in a way that the new information to be acquired is built on older knowledge previously learned there would be a discontinuation created in the learner's knowledge and such a break in the continuity of thinking will lead to mathematical difficulties and their self-confidence will weaken. (Lunde, 2005, p. 13)

When it comes to mathematical language, Høgmo (1995) explained that what students with minority languages struggle most with is when they have to participate in dialogues with others. Students in these situations must interpret what is being said before formulating and communicating their thoughts. The most form of language use in mathematics is text tasks. The students must read the text, analyse the information given, interpret it in a mathematical context, and make use of the information derived from the text in a formula. After that, the students have to communicate the answer they received in a coherent sentence and explain their ways of thinking.

In Glenberg, et al (2012), we can see that the understanding of the language used in exercises and mathematical calculations are regarded as two concepts that are interlocked. It is perceived that mathematical comprehension relies on the understanding of the text exercises given. Here, the authors have introduced an interesting approach, the "Indexical Hypothesis", where IH is defined to assert that "that meaning arises when words and phrases are indexed, or mapped, onto relevant experiences, and those experiences are integrated, or meshed, as guided by syntax" (Glenberg et al, 2012, page 3). What is of relevance to this research is the concept that understanding new concepts can be connected to previously acquired knowledge and building up from it.

Bilingual education allows pupils to be able to receive their education in Norwegian at the same time that they can also use their dominant language and usually, that is going to be their mother tongue (Lunde 2005), to acquire professional knowledge. *"Både OECD, UNESCO og EU anbefaler imidlertid at morsmålet nyttes som opplæringspråk i skolen så lenge som mulig, men særlig bør den første lese- og skriveopplæringa skje på morsmålet"* (Engen & Kulbrandstad, 2004, p. 181)

With this, what is being said is that the students would benefit from teaching practices that linguistically start from the student's mother tongue for better learning.

There are probably some advantages to knowing several languages, for example you can communicate with several parts of the world and in this way, you have access to more resources for learning that is available only in one language. In an international subject such as mathematics, it can be an advantage for those who want to learn the subject and are fluent in several languages because they can make use of several learning resources related to the subject. The same will apply to a student with good skills in several languages when learning mathematics. Good skills mean that the student can understand, speak and write that language because there are many learning materials in mathematics in several languages that they can acquire, practice, and master. Pupils who know several languages are then at an advantage over another pupil who only knows one language in terms of more resources to learn mathematics through, but learning materials alone are not enough if they are not combined with the right learning method. I will discuss several of the negative effects of training in multilingualism later in the essay.

As mentioned, this student can be in the classroom and receive his training in Norwegian and if there is still some confusion, this student can look up and make use of other resources such as video explanations of academic topics in the other languages he or she is fluent in. Multilingualism is not a resource that only the students themselves can use, but rather it is a resource for others in the class to benefit from. In the same way, this also has several positive effects on the quality of teaching and the environment in general in the classroom.

2.1 Reception classes and introductory classes

Everybody have been to schools everybody seems to know in one way or another how schools generally run. The classroom build-up the number of students in one class to the expectations from the teachers to the subjects that are taught but the same cannot be said for reception classes an introductory classes. Well everybody have been through ordinary classes very few of the societies citizens have gone through reception classes an introductory classes and therefore the idea behind those classes remained a bit unclear. According to Norway's public investigations (NOU) newcomer students the go and lower secondary schools have the right for six months up to a year in reception classes or other type of introductory classes and then

are expected to follow ordinary teaching . Although this period of time can you prolonged if so the student shows the need for it.

“Oppholdet i alfabetiserings- og mottaksgruppe varer vanligvis i ti måneder. Oppholdet kan forlenges hvis det er ledig plass, og dersom alfabetiserings- eller mottaksskolen, i samråd med bostedsskolen, anbefaler en forlengelse ut fra tungtveiende pedagogiske hensyn. Lærere i Osloskolen har gitt uttrykk for at 10 måneder i mottaksklasse ikke er tilstrekkelig og at en ønsker å beholde eleven lenger tid der. Det gjelder særlig de elevene som må flytte til bostedsskolen i løpet av 10. klasse.”(NOU 2010: 7)

In this situation of Norway's public investigation it is possible to see that the teachers that work in these classes have expressed their concern that this period of 10 months is not enough for the students to get there adequate knowledge to follow the teaching in ordinary classes. As a result to that one can only assume that there would be some students that moved to ordinary classes that are not fully capable of reaching their full potential in ordinary classes due to insufficient time in those introductory classes. These classes should play the role off a bridge for the students to cross from learning in their home country to being able to learn in ordinary Norwegian classes.

2.2 Benefits of multilingual mathematical teaching

2.2.1 Benefits for the students

By knowing several languages, there are more resources for learning that the student can use to acquire knowledge. This takes shape in classrooms where teaching occurs in the majority language of the class, students can read through the same material alone or with the help of the teacher, but in their mother tongue or the language they are most comfortable speaking. In the technologically influenced world that we live in now, it has become easier to find the same learning materials, but in different languages. Schüler et al (2017) says that the best approach to providing vocational training for multilingual students is to use your first language as a basis for building on more knowledge. In this way, Lunde (2005) believes that students will benefit the most because a student who knows the mathematical concepts in a language but lacks the Norwegian equivalent of this word, does not mean that this student has

to learn the concept again. "It is important to look at the child's overall competence in both languages" (Lunde, 2005, page 13).

Alongside understanding subject contents, the need to build a subject-specific language is of utmost importance for the learner to gain mathematical language for this does Brinton, Snow and Wesche (2013) perceive would give a better and fuller understanding of the subject. This, combined with Lunde's (2005) views on teaching mathematics for non-native students, shows an encouragement towards using the students' mother tongue or first language to establish a better learning of mathematical terms and subject-specific topic words.

2.2.2 Benefits for the teacher

Traditionally, all teaching has taken place through a teacher going through the subject material and the pupils receiving their training at school from the textbooks, but now the world has developed technologically and sources for learning have increased. At the same time, the types of pupils have also become different. In a class with several minority-language pupils, they must not be considered a problem that breaks with the usual way of teaching (Rousseau & Tate, 2003). It is therefore important that teachers are aware that some changes will occur and require both the students and the teacher to be prepared for (Rousseau & Tate, 2003, Lunde, 2005) so that students can get better quality of their education. Some of the challenges that Schleicher, A. (2015) and Lunde (2005) mentioned in their articles are that minority linguistic pupils struggle with concepts and term understanding when learning subject material.

For concept teaching, several ways can be used to tackle this challenge, here the teacher can either create groups based on a common language that the students master best and create a list of the terms that are to know in the topic. The teacher would then ask the students to write definitions of the terms in their languages. In phase two of this activity, the students should try as best as possible to formulate a definition of the terms themselves, this time in Norwegian. Later, the students will discuss their findings together in class where everyone agrees on common definitions of these terms.

By handling this challenge in concept learning together with the class, it is not only the language minority pupils who benefit from this activity. It is also the other students who get to reinforce their knowledge, and thus several of the students would have benefited from this

method, ergo making a glossary of terms with definitions written in multiple languages for better understanding.

For better concept and term understanding the teachers can also rely on the use of visual representations that would act as support when solving a mathematical problem. In Matheson and Hutchinson (2014) the authors have established the steps that are involved in solving a problem in mathematics. The steps entail the following:

- 1) Processing the information in the problem
- 2) Selecting important information
- 3) Identifying the goal of the problem

These steps shown can be used with the aid of some scaffolding methods to lessen the cognitive demands that they lay on the students, this put an expectation on the teacher to be aware of and use multiple methods for teaching and scaffolding. By arranging for more varied work methods where students interact with other fellow students, the teacher can create a better class environment, and this increases opportunities for in-depth learning among students.

2.3 Challenges of multilingual mathematical teaching

2.3.1 Challenges for the Students

Burner & Carlsen (2022) in reference to García, Johnson, and Seltzer's (2017) terms on the teacher's ability to have a positive attitude towards multilingualism (stance) and if they are able to apply the multilingual lens (Cummins, 2016) in a systematic way (design). It is explained that the teacher should consider the students' first languages when teaching subjects. In that study some teachers had positive stances towards using the students' first language (called L1 in the study) whereas others did not, but even then, the teachers' with positive stances did not know how to implement the students' L1 systematically during the lesson. Burner & Carlsen (2022) explain that the use of the student's first language was somehow only partially and sporadically taken into consideration during lessons where this use should have been part of a plan. Burner & Carlsen (2022) argued that structured use of L1 should be included in all the teaching practices at the schools, so the students feel acknowledged through their language.

The need to see the student and acknowledge them is part of creating a comfortable learning environment for the student as the first steps towards a better learning environment. “Because of limited language ability, new culture, new school system, intensive coping process, and adaption difficulties, the time when newly arrived migrant pupils enter the new school system becomes a period of highest vulnerability” (Norozzi, 2019, page 2). In this article Norozzi (2019) talked about reception classes in Norway, and there she mentioned how the grouping of children in these classes does not follow the same grouping method done in ordinary classes, grouping by age.

Norozzi (2019) used the abbreviation NAMLP when talking about newly arrived minority-language pupils and in her article, Norozzi mentioned that these pupils in reception classes were grouped by age. This grouping method is not the same throughout all the reception classes in Norway as there are many other factors that come into play. OsloMet’s National center for multicultural education mentioned that the municipality size, geography and the number of newly arrived pupils are factors that influence the grouping of students in these cases. But much like Norozzi, it was explained that there are some of these pupils “have never been to school, some of them have a strong school background, and some have a mediocre and acceptable level of schooling.” (Norozzi, 2019, page 9). Since students in reception classes come are so different, the attention that the student gets from the teacher is going to vary dependent on the needs of the rest of the class and this would add to the vulnerability of the student in the class possibly leading to learning difficulties.

2.3.2 Challenges for the Teacher

It is part of the job of the teachers to find out and use the preferred learning styles within their students to better customize the learning materials. This they would do to aid in differentiating to match the students’ needs for learning. According to Strandkleiv (2006) in reference to Coffield et al. (2004) there are about 171 identified models or theories when it comes to thinking and learning styles. Even if these models and theories were reduced to 13 of the most important, there are still a good number of methods for the teachers to choose from and implement in the classrooms, which can be deemed challenging for some teachers. These difficulties in choosing learning styles and implementing them does not only affect teachers in ordinary classes but teachers who work with students with language minorities who can’t speak Norwegian are also affected by them.

Alongside with learning styles, there is the aspect of having learning materials that the teachers use when working with multilingual students. Burner & Carlsen (2022) have mentioned in their study that teachers often use materials that mainly are in Norwegian, “The learning material used and the classroom environment in the observed lessons did not reflect the multilingual composition of the classes.” (Burner & Carlsen, 2022, page 12). This is a sign of low design for the proper integration of L1 in the lessons, thus teachers need to use more time on lesson preparation to ensure better use of the students’ first language in the lessons. This integration can either be through the learning materials or verbally, depending of the subject and context of the topic.

In classes where there are migrant students, there would be many other difficulties that the teacher needs to take care of. One of those difficulties is the distribution of the attention that teachers in reception classes and adult education schools have between multiple other things than what a teacher in ordinary classes would. Burner & Carlsen (2022) have given taken Finland and Norway as examples. In a survey in Finland, it was shown that 34% of 38 teachers that were in the survey have stated to receive training in working with immigrant students. When it came to Norway, Burner & Carlsen (2022) reported that in a study carried out in 2016, it was found that a mere 20% of the teachers reported having adequate qualifications to teach in these classes with immigrant students.

The lack of training for teaching newly arrived language minority students who receive education in reception classes and adult education schools lays a responsibility on the teacher to be aware of and ready with the knowledge on teaching this student group. This knowledge should nonetheless include knowledge of learning materials used and the level of accommodations towards the students’ learning styles. Therefore, it can be said that those teachers have a number of other responsibilities than teachers in ordinary classes. A possible factor to lessen the level of challenges on the teacher’s side is the number of students in the classroom. Classroom size has to vary between these institutions for learning, ordinary classes and reception classes and adult education classes.

2.4 Methods for increased learning outcomes

2.4.1 Scaffolding

Smit (2013) explicated that the concept of scaffolding can easily be stretched to extend to cover any support given in the classroom whether it is classroom organization or artefacts (s. 141) and thus it is crucial to tread with utmost caution to avoid an overgeneralization. Smit (2013) referred to Gibbons's (2002) strategy for facilitating and enhancing language development in multilingual mathematics classrooms, ergo *scaffolding language*. With the notion of overgeneralization in mind, Smit (2013) took on the explanation that Gippon (2002) used at her definition of *scaffolding language* to be. Gibbons (2002) defines scaffolding as “temporary, intentional, responsive support that assists second language learners to move towards new skills, concepts, or levels of understanding”. (Smit, 2013, s.47)

As previously mentioned, Matheson and Hutchinson (2014) have identified visual representations as a mean to help students with learning difficulties to understand mathematics better. Although this paper will not be taking on the learning difficulties of students, it is interesting to take into consideration the support that visual representations have on the learning of the pupils and count it as a possible scaffolding method.

2.4.2 Visual representations

Matheson and Hutchinson (2014) have in their article served a great collection of the different types of visual representation explained in detail, so I will be taking this article as the main source for theory on visual representations. Looking through, these representations were divided into two categories, internal and external and internal visual representations. For the sake of clarity on the categories, utilized the help of a table of content, can be seen under in table 1. The authors here defined external visual representations as the range of representations that the students have always been exposed to. Therefore, these representations are deemed easier to teach and simpler to learn through because many are familiar with them. Where as internal visual representations are more default to show the students because the imagery takes place in the mind of the learner.

External visual representations	Internal visual representations
Diagrams	Creating or recalling a visual imaginary
Graphic organizers	Creating internal imagery through verbal modelling or prompting through drawings

Table 1: On the right are the external visual representations and on the left are the internal visual representations.

Matheson and Hutchinson (2014) explained that internal visual representations require the use of previously known knowledge combined with new information from the exercise they are working on. While external visual representations are easier to conceptualize considering the nature of them giving the teacher the creative liberty to show and manipulate. While these representations are dependent on the type of information derived from the exercises, the students are taught that some are better suited for a certain type of data being dealt with.

Focusing first on the EVR, both categories, diagrams and graphic organizers were further split into multiple subcategories shown under in table 2. Later in this paper it will be seen that the teachers have taken use these representations somewhat similarly.

Diagrams	Graphic organizers
Tree diagrams	Semantic map
Number Lines	Semantic feature analysis
	Syntactic/ Semantic feature analysis
	Visual displays

Table 2: Listing out the subcategories that fall under both Diagrams (on the left) and Graphis organizers (on the right) as part of external visual representations.

While each of the subcategories was explained in detail in Matheson and Hutchinson (2014) they will not be discussed here, though it is important to note that some subcategories are more suited for different uses than others. The authors have made explicit that semantic maps and semantic feature analyses are better suited **for recalling facts** “though they are more difficult to understand and to learn how to use”. While syntactic/semantic feature analyses

and visual displays better were believed to be suited as **more efficient for making computations** to solve problems, and for recalling the information within these types of graphic organizers. The authors have in both explanations above referred to Dexter & Hughes' (2011) article on graphic organizers and students with learning disabilities.

The second part of VR is the internal visual representations here this category was also divided into a couple of subcategories, *visual-chunking* and *visual schematic representations*. An explanation to that each under category is defined as can be seen in below in table 3.

Internal visual representations	
Visual-chunking	Chunking is the practice of combining bits of information that are related in some way in order to reduce the overall amount of information for easier processing
Visual schematic representations	Creating diagrams of mental images as well as by thinking aloud as students are visualizing while problem solving

Table 3: Listing out the subcategories that fall under Internal visual representation.

2.5 Mathematical language

2.5.1 Written and oral mathematical language

Language in mathematics consists of both the written and the spoken language, these two form for language make the basis for learning and working with the subject. As previously mentioned in the introduction the Directory of Education (utdanningsdirektoratet) has stated basic skills (grunnleggende ferdigheter) in school subjects. In mathematics there is a great focus on enhancing the oral and written skills of the students. For the oral skills, it is important that the students can communicate their ideas and discuss problems using a mathematical terminology, alongside with explaining strategies and solutions with others. While for writing skills the students are expected to explaining connections, solutions and ideas using the appropriate mathematical representations.

Taking into account Gippon's (2002) explanation of Michael Halliday and Ruqaiya Hassan's (1985) three variables for understanding text it is interesting to note the aspects of *field* and *mode* of a text since the focus is on the oral written skills in mathematics. Gippon (2002) shared Halliday and Hassan's explanation of those terms, where the first one, *field*, being the topic of the text ergo the context that is being talked/ written about and the latter, *mode*, being the form of communication, it being written or spoken.

2.6 Previous research

Throughout further investigation on the theoretical background for this subject, many terms such as bilingual teaching, education in the first language, and mathematics learning methods were some of the central concepts that constantly came up and thus will be discussed in the discussion part of this paper. These concepts have had a repeated occurrence in the interview with the teachers as well, it was remarkable to see that the teachers were aware of the different factors that come into play when teaching mathematics to those students. The use of first languages have gotten more attention in the recent times. Therefore to get a better understanding on the importance of this subject we take a look at some studies and organisations that have directed spotlight on the matter and worked for the spread awareness on the effects that they harbour on multilingual individuals.

Several investigations have been carried out on multilingualism in students who come from multicultural backgrounds. Language and language barriers were seen as possible factors in the creation of hurdles and obstacles in these students' learning other subjects in Norwegian. MTB-MLE, mother tongue-based multilingual education, is presented in Ruanni Tupas (2015) paper on the Inequalities of multilingualism. Tupas (2015) explained MTB-MLE as "broad framework of educational provision which essentially means the use of learners' first languages or mother tongues as the primary media of instruction" (Tupas, 2015, page 112). Organisations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) have also recognised the importance of vernacular languages in education and were promoting it since 1953 as means to "improve learning and learning outcomes and give life to linguistic and culture diversity." (UNESCO, last updated: 13. March, 2023). The ideology here is about not prioritizing the use one language while completely dissimilating the role of the other in learning and education.

Collier (1995) shows a study results on the non-native speakers' performance in schools with quality bilingual program (4-7 years) which leads to their ability to manage to show cognitive and academic growth when compared to the native speakers' performance who they surpass across all subject areas.

3 Method and selection

3.1 Method for collecting data

The method that has been used to answer the thesis question of this paper is in the form of interviews with teachers who master and use multiple languages in their teaching. The interview followed a semi-structured interview guide that was used as an index throughout the interview, but I still could ask other questions. This interview method was decided after Christoffersen & Johannessen's (2012) explanation of research methods on interview-based research on teachers:

“Ved utarbeidelsen av intervjuguiden vil forskeren først identifisere sentrale deltemaer som inngår i den overordnede problemstillingen. Noen ganger nøyer forskeren seg med å spørre om disse temaene, men som regel er spørsmålene ment å oppmuntre informantene til å komme med utdypende informasjon.”
(Christoffersen & Johannessen, 2012, s.79)

Thus, dependent on the answers given by the interview subject it was decided whether to follow through with additional questions to further elaborate certain aspects of the data acquired, or simply move through to the next question in the interview guide.

Furthermore, all the interviews that I had received the chance to do with the interview subjects have been sound recorded after signing a written consent including necessary information on the research they are partaking into. The sole purpose of sound recording the participant during the interview is to not miss any important answer from the teachers due to the fact that the interview had an estimated period of 30 minutes. While the estimated time of the interviews may be of standard length it is to be expected that they may stretch longer since semi-structured interviews can be altered to acquire deeper knowledge from the interview subjects (Christoffersen & Johannessen, 2012). Thus has Bjørndal (2002) with sound recording of the interview it is possible to preserve the situation and replay it multiple times each time unravelling a new piece of dialogue and details in a speech that may have been previously left behind.

Prior to starting the interview, every teacher partaking in this project has been given a recap of what the research entails and the purpose of the interview. In addition to that, every

participant has gotten a read-through of all their rights regarding giving consent to being interviewed and sound recorded. It was explicitly stated in both written and verbal notations that all partakers are free to withdraw their consent to any of their recorded materials any time they so wished to. Furthermore, it was established that there should not be a high threshold for getting in contact with either myself or my supervisor regarding anything from participation to information about the research. Finally, they were asked again if they still consent to being part of the project fore proceeding with the interview.

3.1.1 Type of data collected

As previously discussed, the research method used is a semi-structured interview with teachers of multilingual backgrounds. This method generates results and answers of qualitative nature since this method is focused on a small number of the interview subject. As mentioned in Christoffersen & Johannessen (2012) with qualitative methods it is possible to get familiar with (Golafshani, 2003) and have a deeper understanding of the phenomenon studied. This is because when utilizing this method to collect data and approach the matter to be studied it gives a clearer perspective and understanding (Denzin and Lincoln, 2005) of the matter in its “own specific context and the meaning that individuals bring to them” (Almalki, 2016, s. 291). Therefore the results that will be generated out from this research will be the practices, experiences, methods and reflection of the teaches interviewed. These results will be presented in their natural form, without interpretation, before they would be analysed and compared according to the categories for analysis. An explanation to what those categories entail will be done later in part 3.6 of the paper.

3.2 The selection

The selection of participants who took part in this study encompasses bilingual mathematics teachers who can speak multiple languages and have worked with students who are non-native. A common characteristic between these students is that they are of multicultural backgrounds who can speak different languages than Norwegian. Although the aim was to have as many teachers as possible it was only three teachers that I have managed to recruit as participants in this project. The pool of interview subjects way seem a few, but regardless they worked in reception and adult education classes and therefore they still are legitimate candidates that fall under the premises and the aim of this study.

As mentioned, the teachers in this project work in adult education schools teaching adults and low secondary schools teaching pupils between the ages of 13 to 16 namely eighth to tenth graders. These teachers happen to have varied years of experience. This master thesis was due in a limited time and thus this created the need to get interview subjects to participate within a certain period of time. Meaning that the prospect of varied years of experience was due to the factum of availability of research participants and was not necessarily a focal point of study.

3.3 Recruitment process

The recruitment process of the first bilingual mathematics teachers for the interview entailed sending an email to principals of 4 adult education schools (voksenoppl ring skoler) in the city of Oslo. This email was sent with information regarding the research project, a request to recruit willing multilingual teachers to participate in the interview, and lastly attached in the email was a consent form that participants must read and sign before the interview took place. In return it was only possible to recruit one multilingual teacher, Tom (a pseudonym), he is of Norwegian ethnicity, but can speak English, Tagalog and some Russian, to participate in this research project.

To get one of the other recruiters for the interview, I got in contact with the head of reception class department at a lower secondary school that I knew of whom I explained the project, send a file with the information and the consent form to. The head of the department in return forwarded them to his teachers and the ones that wanted to participate took in contact with me regarding the participation in the project. By this method it was possible to get an interview with Linda (a pseudonym) a young teacher who came to Norway a couple of years earlier, she can speak, English, Norwegian to a certain degree and had her formal education in Russia.

The last person to be recruited as interview subject for this research is Nina (a pseudonym). She is a lower secondary school teacher that has a lot of prior experience on teaching from working in ordinary classes before she stated working in reception classes. She was recruited through acquaintance and agreed to be part of this project after hearing about it directly from me. Nina is also not of Norwegian ethnicity, while her first language is Arabic she can speak English and Norwegian well.

3.3.1 Consent form

The consent form can be found under attachments later in this paper, attachment number two, this form includes all the information and the grounds of this research paper. It includes the bases of the study and has the ideas that research questions are based on as well as stating the purpose of the study. The form then provides the participants with all privacy measures that will be taken into consideration regarding collecting, storing, processing, and the anonymizing any of the personal information in the data.

Furthermore, in the consent form, it was included my contact information and the supervisor that was assigned to this project by the university of Oslo. It ensures a low threshold and establishes openness towards the participant to take contact if they wish to take part in the project or in case they wanted further information about any parts of the project.

3.4 Anonymizing of data

All the names mentioned in this paper are pseudonyms used to protect the personal information of the participants. No personal information that can be used to identify the interview subjects will be disclosed in this research paper to ensure the full anonymity of the teachers interviewed.

Regarding personal information, all the data on partakers that are collected in this research and that can be used to identify them such as names, contact information, or workplace, will be saved and safely secured. It was of absolute necessity to make it clear for all participants that these information will be anonymized and stored to be used for the sole purpose of this study and will not later be published with this paper, then deleted after. The participants were also informed of their rights when agreeing to be involved in the study. As specified every partaker is free to withdraw their consent of participation at any given time and they can have their information removed and deleted.

3.5 Questions for the interview guide

As previously mentioned, the chosen research method to gather information through is interview with teachers of multilingual backgrounds who teach pupils also are of multilingual backgrounds but cannot speak Norwegian. The interview guide utilized in these interviews was semi-structured made with the intention to build on the answers given by the teachers

since it's their ideas and expertise that were sought after. Bjørndal (2012) wrote that utilizing an interview guide in a semi-structural format gives high level of flexibility regarding the previously mentioned intentions to build on the answers given by the teachers. "Intervjueren kan endre rekkefølge på spørsmål eller temaer ut fra hvordan intervjuet utvikler seg" (Bjørndal, 2012, s.97)

Since the questions in the interview guide are formulated to get an insight on the teachers' experiences and practices it is expected that the tempo and the direction that the interview take will vary from one interview subject to another. With that thought in mind, the result of the interviews will be presented in accordance with the natural flow of each interview. Therefore, there will be differences in the order of what would be presented and eventually it may not follow the same order of how the questions of the interview guide was formulated in. Regardless the overall body of all the answers presented, all the interviews have gone through the introductory, main, and concluding part of the interview guide.

As could be seen in the attachments, part one, that the interview guide is divided into 3 parts. The first part of the interview is the introductory part where the interview subjects get settled into what the interview is going to be about. The second part is the main part of the interview, from this part is this is where most of the answers were given that will be used for analysis. Lastly is the concluding part of the interview, the goal in this part is to round off the interview with any thoughts, points of view, or opinions that the interview subject wants to share or comment on that they did not have the chance to do during the interview.

The questions in the interview guide are formulated to be open to insure a better insight into the experiences of the teachers. Most of the questions that revolve around the teaching methods, the challenges, and reflection are of open type. This gives the interview subjects a chance to freely answer and draw in themes that can be of relevance to the research. This can also give the interviewer better windows to share their views and ideas and indulge deeper in them. Alongside the open questions, others were closed like the first three questions in the introductory part that are tasked to facilitate the background and context that each teacher is grounded from.

3.6 Categories for Analysis of data

For the analysis of the data collected from the interview subject, categories for analysis were created in a deductive format. This means that the main goal of the paper is to test the thesis question and hypothesis based on previous knowledge in the field. Therefore, the questions in the interview guide and the categories for analysis were formulated to assert the teaching methods that teachers use and how these teachers can use the students' first languages to better their learning outcomes. While the main categories were thought out before starting the interviews, the subcategories were gathered from the answers of the interview subjects.

The categories that I used for the analysis were the following: the teaching methods that teachers used in the classrooms and the challenges of using multiple languages in teaching mathematics. The methods in the first category have been from lesson planning, while teaching, or how the teachers use the words in examples and explanations. The last category is the challenges that those teachers face to make to mathematics learning in their teaching practices all the while adapting to language differences and caused by the learners or their teaching institutions.

The two aforementioned main categories were generated from the thesis question chosen to discuss in the paper and the subcategories where ones that were gather from the answers of the three teachers in the project. This means that the results, patterns, and ideas concluded may only serve the purpose of discussing the ideology of an exemplified perspective of multilingual teaching in mathematics and not whole picture of it. As a result of that, it must be noted that the results, patterns, and ideas cannot be used to distinguishing broad generalization regarding the reality of multilingual teaching. The results and the analysis driven will have the purpose of discussing the thesis question and deducing whether the hypothesis conjured aligns with the results perceived or not.

3.7 Ethical side of research

When doing research on teachers either observing, video recording or just having them as interview subjects it is important to be aware that there are some ethical measures that researchers are ought to take into consideration. One of those ethical boundaries entails the respect for teacher as individuals, their practices, and their individuality. One important consideration that Arifin (2018) mentioned regarding the ethics of having interview subjects

is the concept of “cultural and linguistic barriers”. Linda, a lower secondary teacher, firstly mentioned in the recruitment section of this paper is a newcomer to Norway and her department manager advised that the interview to be conducted in English so Linda can better express herself even though she understood Norwegian well. With this in mind, prior to the interview, I prepared the translation to all the interview questions. Even before the interview itself I had a read through of the consent form translating it to English so that Linda has full understanding of the content regarding the project, her rights, and the contact information if she has any questions.

Another aspect of the ethical sides of this research is the notion of having participants share their practices and experiences working in the classrooms. It is not ethical to analyse their practices and approaches to using multiple languages under certain lights of either good or bad. The results in this paper present the different practices of teachers when dealing with bilingual students and it can be considered condescending from the researcher if the participants or any of their practices, were to be painted any of those as good or bad.

3.8 Validity and reliability

As a critical part of research, validity and reliability are important prospects in research to ensure credibility (Golafshani, 2003) in the results acquired and the analysis of these results (Creswell & Miller, 2000). Therefore it is important that this project as well gets evaluated on its validity and reliability.

3.8.1 Validity

In terms of validity, it is important to look at Creswell & Miller (2000) who have referred to multiple lenses for validity in terms of qualitative research, one of the referred lenses requires the reading of the research paper by external individuals. The review process is intended to give fresh insight into the research and help facilitate whether the results were interpreted to carry through the researcher’s coveted verdict. “Reviewers not affiliated with the project may help establish validity as well as various readers for whom the account is written.” (Creswell & Miller, 2000, 125). Therefore, this project has been read by multiple people other than me. This method helps keep the analysis of the results in light of the thesis question while making sure they are not biased towards the researcher, nor was they overanalysed and over interpreted.

There are other measurements that would have helped to ensure validity in qualitative research than just using external individual to read the interpretation of the data materials and the discussion of them. One of these measurements are the use of other methods for gathering data as having a mixed method approach to the research and triangulating as mentioned in Gleiss & Sæther (2021). Gleiss & Sæther (2021) have given example of other research methods like observations and field notes, the use of questionnaires, video recordings and analysis of student materials. Due to insufficient time to write this project it was possible to carries out any other of those methods.

3.8.2 Reliability

To truly fulfilled the requirements of reliability it is important to understand what the terminology genuinely means. Taking the explanation Golafshani (2003) used, it is indicted that the concept of testing reliability in qualitative method is used to ensure the quality of the research and results acquired. By evaluating the reliability of a project, it is possible to ensure that the results gathered and presented are not bended to match the researcher's own goals with the research.

Golafshani (2003) explained also that it is important that the informants in the interview, data analysed and other sources for data corresponds with the aim of the study and the thesis question. In this study, the aim is to study teacher practices in reception and adult education classes and therefore teachers from those institutions were outsourced. A higher number of research subjects can contribute to more reliable results in research, but in this project the number of informants to be interviewed were few. This is due to the availability of these teachers and their willingness to participate.

4 Results

In this part of the research paper, I will present the results of the interviews carried out with the three teachers that were mentioned in the selection part of the research. These interviews have taken place by using a semi-structured interview guide that can be seen in the attachments part one. As previously mentioned in the method part, the questions in the interview guide were formulated as a base for the interviews but not strictly bounded by it. The final shape of the interview was dependent on the extra topics and matters that the teachers drawn in the answer. Therefore, it is important to mentioned that these interviews have had similarities caused by the interview guide and differences caused by the teachers mentioning of other topics and matters.

The three teachers that I will present their answers are Tom, Nina, and Linda. These are the ones that I have had the opportunity to include as main resource for data for this project. Therefore, the following results are a mirroring of their plans, practises, and teaching methods. The results part would have admittedly taken another direction if the selection of the interview objects had been different from these three teachers.

4.1 Interview with Tom

The first of the interviews was with Tom, as previously mentioned alle the names mentioned in this paper are pseudonyms for the sake of anonymity. He is a teacher in an adult education school (voksenopplæring) and has taught mathematics to multilingual learners for 9 years. He has, by the time of this study, has been working in classes where students have backgrounds from different cultures and ultimately speaks different languages. These languages that Tom masters are Russian, Tagalog, English and his first language being Norwegian. His students often use laptops in class to work with digital learning materials, otherwise he makes and gathers worksheets that they get to work with.

Although Tom is currently teaching in classes of 10 to 15 pupils, he has previously worked in smaller groups in adult education schools where his main role revolved around assisting pupils in an ordinary classroom with what difficulties they may face with language and mathematics. Tom would either have one-to-one teaching or take a small group of students for some intensive language support, Tom would also work as an extra teacher in classes that had students of multilingual backgrounds. These experiences with working in flexible groups and

with diverse students have enabled Tom to be occupied with finding alternative learning materials. Tom explained that to support his students with learning new materials he has to always be on the lookout for learning materials that make it easier to teach and learn mathematics even with the barrier of language.

During the interview, I asked Tom if he could identify the biggest differences between teaching in a class and working one-to-one with students and his answer was as follows:

“the biggest difference would be in one-to-one for then it (the teaching) would get intense because it’s only the two of us while when it’s a bigger group then I can have it that student can explain to each other in their languages”

Then Tom proceeded to explain how some of his students are passionate about wanting to explain to others what is being taught, and therefore Tom wanted to use these students to create opportunities for peer learning using their common first languages. Based on that Tom makes sure to provide this student with time to discuss the materials taught using their first languages through multiple occasions in one lesson. This way he wanted to make sure that everyone is on the same level of understanding as the rest of the class before continuing with teaching.

Leading on from that answer I found it natural to ask if this method, giving the students time to use their first languages to explain the subject matter to one another, has been effective and how did Tom make sure that what has been explained is correct. Here the goal was to find out how Tom checks the students understanding, where he replied:

“well sometimes I ask the student if they have understood or not, I try to give them a similar exercise of the sort to see if they understood, but in all honesty sometimes the conversation between them prologues and I have to break the conversation, and rather come back to them when we get to solving exercises”

Proceeding with the questions, I asked Tom about other teaching methods that he uses to accommodate the linguistic challenges that his pupils may face throughout teaching. Where Tom took a little while to ponder on the questions before he answered:

“Well in mathematics it’s important to do enough exercises to master the concept taught and exercises with a lot of text may be difficult to decode

dependent on the pupils' linguistic abilities and so I make sure to always start the lessons with a text task that we go through together."

When asked to explain what he would define as lacking attributes that contribute towards a pupil's inability to solve text-heavy tasks, replied that a lot of words that otherwise may be considered common can prove to be challenging for his pupils who have insufficient vocabulary. Tom explained the importance of learning together as a group is to pinpoint words that the pupils find unfamiliar to explain, then referred to the previously mentioned method of using the pupils to explain to each other.

As important as expanding the pupil's vocabulary on the everyday language it is interesting to conceptualize an understanding of the subject matter terms that are to be used in mathematics. When teaching students everyday words in a new language it would often suffice with giving them the translation of the word used. For example, introducing the word for table in Norwegian would be "bord", everyone knows the concept of a table thus it's enough to provide the learner with the translation of the word. On the other hand, when it comes to subject term in schools it is not enough to give translations given that the learner may or may not have previously learned the term in their home countries. Therefore, is it of importance to the learner that the teacher explains the context that the term naturally exists in and the use of the mathematical rule that follows with this new concept.

I asked Tom how he approaches that matter considering the importance of the mathematical language as part of the basic skills that is expected of alle schools in Norway, to which Tom showed me a webpage made by Oslo Met's Nasjonalt senter for flerkulturell oppl ring. Tom explained how that webpage lists out a multitude of documents that encompass most of if not all glossaries used in mathematics translated into 16 different languages that he makes sure his pupils actively use. As can be seen in figure 1, these lists do not only contain glossaries and their translation into another language, but also a column for explanation of the context the terms naturally occur in. In some cases, the explanation may also contain an example of the calculation and application of the rule.

Median	الوسيط	<p>Medianen til 8, 15, 3, 12 og 5 finner man ved å sortere tallene i rekkefølge, og finne det midterste tallet.</p> <p>8, 15, 3, 12, 5 sortert blir 3, 5, 8, 12, 15 $Median = \underline{\underline{8}}$</p> <p>Hvis antall verdier er et partall (to tall er i midten), finner man medianen ved å ta gjennomsnittet av de to midterste tallene.</p> <p>4, 12, 1, 7 sortert blir 1, 4, 7, 12 $Median = \frac{4+7}{2} = \underline{\underline{5,5}}$</p>
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Figure 1: This picture is an example of a term definition from the website that Tom mentioned. Here it shows the mathematical term “Median” in the first column and its translation to Arabic in the second column. In the third column there is an explanation of the context that the term naturally exists in alongside a couple of solved examples.

Remaining on the theme of the importance of languages’ contribution towards a better understanding of mathematics, Tom chose to share an instance in his experience where he had a pupil. This pupil he shared said was sceptical to him because she could not understand him fully and she did not like having a male teacher and to that Tom made an effort to learn words and phrases in her language to try to make her comfortable in class. This helped him build a decent enough relationship with her so that she is comfortable in class. He then proceeded to explain that after ensuring a comfortable learning environment for her, he discovered that she knows sign language. So they had to have an expert in sign language come in to help her. The reason to why she knows sign language was not disclosed by Tom, but I only hypothesised that she could have a family member that had hearing issues because she herself could hear well. The aftermath of that was that this student understood some concepts in the subject better. This method Tom explained had worked better than if he himself had tried to explain to her. Tom here was unsure whether he would mention the story because he was not sure that it would count as using other languages in teaching mathematics, but he decided that he would. This is because he firmly believes that approaching a person by speaking their language is the door to providing comfort and familiarity and that would pave the way into learning.

Tom mentioned that since he works with adult learners, he would always make sure that the math that he uses “can be used in real life”. When asked to elaborate further he answered that

since he teaches both Norwegian and mathematics, he would use that to his favour because his focal point of mathematics teaching is to get those adult learners ready for their plans once they are outside of language learning classes.

“It’s kind of a new thing that I’m trying with the pupils since I teach them Norwegian too, we read texts in Norwegian about daily life and then I use parts of that text later in a mathematical context. We are currently working with personal economy in class and so we work with exercises like budgeting, salaries, taking or paying loans, and credit cards.”

Tom emphasized that by introducing a text passage in Norwegian class he could focus more on the meaning of words and create an understanding of the events happening, so then he could easily retrieve the text when he gets to math class. Tom expressed that in this way he puts mathematics in a context that is better understood by the pupils, and he would not have to utilize time from the math period to work with text understanding and rather focus on applying the mathematical concepts.

Another adaptation that Tom sometimes makes use of in his class is requesting the assistance of experts in certain languages to support and help in translation in the subject. He explained that in some cases he gets pupils that can’t speak English, nor can he speak the pupil’s mother tongue, nor would there be other pupils that speak it and thus it is needed to scout other means to facilitate understanding in this pupil. The idea that was to call in an expert to class that Tom have explained had generated better results with that pupil than what Tom would have accomplished without the extra assistance. The expert worked as an extra teacher and would always be with the student and having this intensive linguistic assistant managed to help the student progress with her vocabulary all the while maintaining the same level of academic achievements as an average pupil would. Later when the pupil learned enough for her to carry simple communications, the expert would lessen his help as the pupil needed less follow-up as time went by and could start transitioning to continue learning with the rest of the class.

Tom has had his all his formal education in Norwegian, but he is always aware of the extra load that learning mathematics in another language haul mentally on the learners and thus he ventures to find other outlets to lessen that mental stress on them.

“to use the students language while learning and taking base from that when wanting to introduce a new topic or concept has proved productive in getting

my students to focus better and increase their tolerance window towards new materials and thereupon aid with their security in learning”

Having a language expert assisting with the language barrier explained Tom had given better results than only relying on translations between some of his student. As he previously mentioned sometimes the conversation between some students would take longer than expected to, thus he needs to decide when to intervene and interrupt them. This explained Tom could be intimidating for some teachers because not only can the teacher not control what is being said in the other language, but there is a certain control taken from the teacher. Therefore, peer learning can have both negative and positive sides that the teachers should be aware and conscious of to be able to properly use the method. This methods like other have its effects on the students, whether it inhibits or promotes learning in students. This method of teaching is undeniably a cheaper option to hiring translators, but again it all comes down to the teachers' ability to effectively use this method or eventually terminate the activity if it did not live out to its full potential due to other factors.

“the ability to listen to conversations in class and check if they're of any relation to the topic taught is part of the control that the teacher has in class and having to let go of that control can be intimidating for some. Unless the method is to be utilized correctly.”

In the aspect of showing calculation of equation in mathematics Tom mentioned that he feels the need to know of and be prepared that some of the participants in his class could have been taught different symbols for procedures during calculation. Tom clarified his answer by giving examples of instances where participants used symbols that are of norm to them and unusual in the Norwegian context.

“In Norway we use : a sign for division alongside with / when we work with fractions, whilst I had an Arab student who was used to using ÷ in his division. Funny enough is that this symbol ÷, we use it in some places in Norway to mean subtraction when for others it indicated division.”

According to Tom the same could be said for multiplication using “x” instead of “·”. This was kind of shocking for him when he first started teaching multilingual students because he thought mathematics was free from cultural influences and thus should have been standardised.

In the concluding part of the interview, the goal is to get the final thought of the interview subjects before rounding off the interview. In this part Tom was asked what sectors of education should have more bi- or multilingual teaching and what sectors should have less. Tom took a moment before expressing how this type of teaching should be summoned as early as the need for it occurs though reflecting on the applicability and practicality of it this though.

“In a perfect world language assistance should triggered as an immediate reaction to having a student with less language skills than his or her peers, but this set a bigger demand for more multilingual teachers than there is supply for currently. Regardless of this, if students can get intensive support as early as possible and have that support lessened as time goes by it can help the results of their future education.”

Tom continued to explain how the need for lingual support should be the deciding factor in the equation of whom should get more bi- or multilingual support rather than the sector of education. His notion of speaking revolved primarily on the pedagogical importance of going from the known to the unknown is an important principle in education that should also apply when learning a subject in a new language.

By the end of the interview Tom was asked to recall three ideas that he perceives are the most important regarding everything he had discussed in this interview and if there is anything he wants to add to that. Tom described firstly how there should be more language assistants available in all sectors of education regardless of subjects taught to give professional support to both teachers and students in class. Secondly, language support in subjects should be triggered to help student as early as the need for support occur. Lastly, teachers across subject should work together to create learning materials that are language sensitive and is dominated of flow and connection to the lives of the students to guaranty a better chance for them to learn, master and then use the knowledge acquired.

4.2 Interview with Nina

The second interview carried out was with Nina, a 1st-year bilingual teacher in reception class (mottaksklasse) in a lower secondary school (ungdommskole) in Oslo. Nina has had an extensive experience of 25 years teaching in ordinary classes, but she only got to work in reception classes for about a year from the date of the interview. Nina is a middle-aged lady that is not of Norwegian ethnicity and have had her formal education in French and English in another country. She alongside those two languages can speak Arabic and Norwegian.

While working in reception class, Nina had a group of 20 pupils between the ages of (13-16) that had different cultural backgrounds, whom she followed during that year. Alongside her was another teacher that taught both Norwegian and mathematics where they both get to plan the lessons together. In her 25 years of experience Nina has always worked with students in ordinary classes in a lower secondary school, her classes usually consisted of an average of 26 students who are aged 13-16. In those classes that she worked in, she commented that they would be considered linguistically homogeneous classes where on average the students spoke fluent levels of Norwegian, apart from the 1 or 2 students that usually started in ordinary classes after they have been in reception class.

Nina explains that she often worked towards and prioritized in depth learning and that she is always on the lookout for methods that could help with facilitating better learning outcomes within her students. After Nina started working in reception classes, she explained how her priority has not changed and she still aspires to make learning less cognitively challenging, more educational and rather enjoyable especially for those students.

“this week, we are currently working with geometry, in this topic we decided to have the kids draw and make many of the figures that we teach them, we want the kids to form knowledge about the concept in the best possible way with the least possible cognitive stress since the students have to use a lot of energy to adapt and decode different situations with the unfamiliar learning environment.”

With this Nina explained that the students in reception classes tend to encounter various challenges, whether it is language difficulties because they don't understand the meaning of some words or academic challenges, that they have not yet learned the topic being taught. Subsequently, Nina explained, that this leads to the students having to use a lot more energy

to concentrate on the subject topics taught in class, a lot more than what an average student she is used to would. Nina elaborated further that this requires that they, the teachers, must rely on using several materials to visualize the concepts when teaching in order to avoid as much confusion and misunderstandings as possible. Nina continued that not only were those materials important to visualise concept in mathematics and take a load off the mentally having to visualise the concepts, but they were also important when the students is going to build deeper understanding in the topic. Since it was her natural domain of working, Nina found the transition to reception class natural, but still she had to make some adjustments.

I then asked Nina, when in the lesson it feels most convenient and effective to use those materials she was talking about. Nina replied that she prefers to use them when she first introduces a new topic and want to check for what the students previously know about the topic and also even when she is sure that the student have no knowledge on the topic from before.

“What is special in reception classes is that we get children that have got to school and got good education and know how the school system works, and we get children that might have not had good lives and have escaped from wars. Therefore, they do not have a normal school attendance and we need to know where they stand in their knowledge and almost always expect that there is someone in class that does not have basics in a topic.”

Nina explained that when working with geometry she would show the figures to the pupils and have them draw them to get familiar with the different attributes that each figure has. Among the materials that Nina showed me was a poster from Matemtaikk.org that she hung up in her class, the poster ccan be seen in the attachments (CHOOSE PART). Then she would tread into what she called “Shape Family”, where she would show and explain the differences between each of the type of figures that belong to those families and then have the students draw them to get familiar with their important attributes. An example of what Nina would show and work with when explaining a certain Shape Family can be seen in figure 2. She used the following list when explaining the difference between the three most known triangles and their special characteristics.

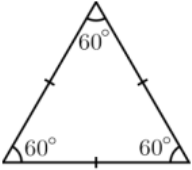
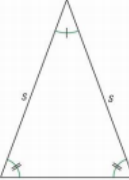
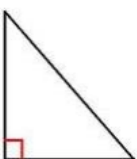
Likesidet trekant		<ul style="list-style-type: none"> • Alle sider er like lange • Alle vinkler er 60°
Likebeint trekant		<ul style="list-style-type: none"> • To sider er like lange • To vinkler er like
Rettvinklet trekant		<ul style="list-style-type: none"> • En vinkel er alltid 90°

Figure 2: This figure is taken from Matematikkensverden.no that Nina have used in her class when she taught about triangles in the topic of geometry. This figure has three columns, the first one lists out the names of the most known types of triangles, the second column is shows what these triangles look like and the third column lists out the special attributes that are linked to each type of these figures.

She explained that she would further divide the students to work in smaller groups of five students at max to make it easier for the children to converse on the figures they are drawing, whether they would talk between themselves or with the teachers. This method Nina expressed allows for the build-up of learning outcomes that are of better quality for the students. This she explained that not only did this gives a better quality for the learning outcomes. Nina mention that it also enabled for more teacher follow-up because both she and her fellow math teacher can circle around to the groups and listen for the students' conversations on the figures they are making and aid with vocabulary when asked.

“Sometimes it’s not as fruitful to just teach them (the students) new worlds, you need to give them space to practice using them and only step in when the students ask for more words to express themselves with their fellow peers”.

Continuing on the matter of discussing other teaching methods that Nina used in class, Nina pointed out how helpful it was to have each group of students create questions after each topic for the other groups to solve. She emphasized on the importance of student participation during learning and so her way of creating variation in that participation is by having them produce questions on the matter and get the others to solve.

“This created a competition between the kids, they would create difficult exercises because they all wanted to be the ones that solved all the exercises, so I had to implement a rule that only the exercises that I and the teacher approve of get passed forward to the other group.”

Picking up from that line of thought I moved on to ask Nina if there were any other challenges in teaching mathematics to her students, to which she immediately answered, “number of new words”. When prompted to elaborate further, she explained how she must always think about the number of new words that she introduces or uses per day, this meant that she could not progress as fast in teaching the curriculum. The number of new words doesn’t just encompass the subject matter terms, but rather also day-to-day words that the students hadn't yet had the chance to learn.

Following the pace of the interview guide, I had to ask Nina how she uses multiple languages in her teaching, to which Nina replied that she steadily brings up and updates a list of glossaries and definitions that she gives her students time to work on and translate to their preferred first language. As mentioned earlier, Nina is not of Norwegian ethnicity and she has had her formal education in mathematics in English, Arabic and French. Therefore, she has experienced learning mathematics in a language that was not her first and acknowledges the importance of understanding both the Norwegian language used in the exercises and the mathematical language that they need to translate the exercises to.

One more important topic Nina wanted to comment on regarding her help in the translation of concept terms to the pupils’ first language is that the students’ first language can be different from their school language. Therefore, it is crucial for her that she gets to know her pupils’ school language and works out from there. Nina gave then an example of a situation that involves a group of students that have Arabic as their first language, but not necessarily the language they got their formal education in. From that group of students there would be some

that had their education in English, Arabic or French, and therefore they cannot be placed in the same group to receive subject term translation in Arabic.

From that Nina has explained that her beliefs and her education has enabled her to provide her pupils with the correct subject matter terms in those languages that she and her co teacher could speak. “I don’t always work with translation of words, but sometimes it’s the best way to go through before we then provide a context for applying those mathematical terms when the students first have fully understood their meaning”.

As for the timing, Nina continued onto how she would use that method when she explains words and concepts for the first time, then she would often switch to using that word or concept in Norwegian in a task. The idea is to show when and where the term is used and how it emerges in exercises so that the students can form a context for working with the term and the formula for it. Nina said that this way her students can get a deeper understanding of the meaning of the terms in a topic, and they would be in a better position to work with it. This as Nina explained would also make it easier for her to show how a new topic connects with something previously explained.

A follow-up question that was natural to ask Nina was as following “what does using multiple languages in teaching mean for bilingual students that has other mother tongue than Norwegian?”. Nina answered that first and foremost by speaking a language that the students know establishes better grounds for forming good relationships with them and subsequently build better channels for communication with them. Nina explains that starting with something familiar to them will give them the security needed to tackle the unfamiliarity of learning a subject in another language than what they are used to back in their home countries. As previously mentioned, Nina is dedicated to creating a comfortable learning environment for her pupils and makes learning less cognitively challenging and more cognitively developing.

“My main concern is to give the students security in learning through word translation and visual representations and using other means. But I try to not let get them dependent on constant translation because then I feel that they would spend less time trying to understand words and concepts from the context they exist in. So, I try to use everything in moderation.”

Using various methods in her teaching in both Norwegian and the first languages of the student, Nina tries to ensure that her students would not only learn the meaning of the mathematical terms in a topic but also how it is used in its context in both the language they find comfort in and in Norwegian. Nina explained how she always aims, with her teaching methods, to avoid any future misunderstandings and the possible formation of learning difficulties in the subject.

Since Nina has extensive years working as a teacher before she decided she wanted to work with multilingual students in reception classes, she had the prejudgment that working in reception classes will not be a big difference, so she was confident in her transition. But against her previous expectation, she marked some major differences between the two teaching classes through her first year of teaching there.

“Ordinary classes tend to need fewer concrete materials and visual aid when learning new topic, some must be used there, but not to the same extent as when working in reception class, that as well as, my choice of words in the exercises”.

Nina explains how in reception classes she has to use more time than she is used to when preparing for class for she must always be on the look for words and expressions that can be perceived as new from the students. Besides lesson planning and preparation for class, Nina mentioned that they are not the only things that take more time than usual.

“Preparations extend not only to what materials or words I use in class, there is also the aspects of what mathematical symbols I get the students to use when calculating. Earlier in the year we observed that many of our students used x to indicate multiplication and that would've caused them problems for when we start working in algebra and due to that we had to put time to explain and introduce “ \cdot ” as the sign everyone in Norway uses.”

Nina's focus point when listing the differences between teaching in ordinary and reception classes included preparation time during lesson planning, the number of new words introduced, learning materials used in the lessons, mathematical symbols and last but not least the exercises given to the pupils and the level of difficulty of those given tasks is also to naturally be considered.

“The children we get in reception class originate from different countries and so firstly their progression in the subject is different from each other and unsurprisingly different from what is expected in the lower secondary schools in Norway. Secondly their individual competencies in the various topic in maths is also varied and that sets a level of demand on us (her and her fellow teacher) to adapt to their needs.”

By the end of the interview, I asked Nina what she could say are three main aspects that she perceived most important from what she have discussed in this interview or generally from teaching multilingual pupils. The first thing that Nina mentioned was that although she has only taught in reception class for about a year, she feels that she has to always be aware of and limit the number of new words and mathematical concepts that she introduces in a single lesson. She said that this is one of the most important aspects when teaching in reception classes.

Secondly, Nina mentioned that there is always the need to use concretes and other learning materials in her teaching, so this creates the necessity to either buy, make herself or have her students make so the availability is a crucial prospect in reception classes since they aid in the representation of complex mathematical concepts. Lastly, Nina explained that as being a teacher in reception class, it is important to achieve a good level of relation and have open channels for communication between the teacher and the pupils to create a comfortable and safe learning environment. Here Nina meant that the students’ engagement and participation in the learning process is preserved with the good levels of communication between teacher and student.

4.3 Interview with Linda

The third interview performed was with Linda, she is a young teacher in her late twenties that works in reception class in a lower secondary school in Oslo. Much like Nina, she too is not of Norwegian ethnicity and has only taught in reception classes for a short while in Norway and by the time of the interview she had only been teaching for about a year and a half. In contrary to Nina though, she does not have an extensive carrier in teaching, she started working right after she got her university degree, and so the class she teaches in her lower secondary school is her first. When asked what age group Linda teaches in her class, she explained that considering the nature of these reception classes it is common to find classes with pupils that are not of the same age. Linda explained that the class she teaches has students that vary in ages, she explained that the students range from 12 to 16 years old and ultimately are on different levels in their mathematical skills. When asked if this creates a bigger challenge for her to adapt and work for their needs and if that itself is a challenge for her. Linda replied that she is not alone and that she is fortunate to have another teacher that worked with her to share the workload with.

Regarding how Linda works around and accommodate for the range of levels in mathematical skills that she has in her class, she explained that she and her fellow teacher has created, what she described as an algorithm. This algorithm she explained they have been thought out and created before she and her co-teacher got know and work with their pupils. The algorithm that Linda talked about have been followed since the start of the year and it had proved thus far to have given positive results when it comes to the learning of her students. This algorithm that she and her co-teacher created consisted of phases for when they introduce, work with, and check the understanding of mathematical concepts. So it is a standardised set of distinct phases that can still apply regardless of the topic that she was going to explain.

It is to be highlighted that with this system that they both have created they focused equally on the linguistical understanding of the mathematical terms and the usability of them in terms of applying the rules and concepts. This system is built up of three phases which are dependable on a systematic interplay of teaching in Norwegian and teaching in the other support languages. When asked to elaborate on what she defines as support languages, Linda explained that the two teachers have English, Spanish and Ukrainian/ Russian as common language that they can speak between them and are languages that the pupils also can speak

and thus they have called them support languages (støttespråk) used alongside to teaching in Norwegian.

“This algorithm that we have created has three phases, the first part of this initial phase starts with us introducing concept terms in Norwegian and their definitions in our three support languages. It is in this phase that we get to work with building an understanding of what the terms mean. The second part of phase one is to introduce and partially work with exemplary word-based exercises in Norwegian to show the context of the concept term we introduced and work on decomposing what the text in the exercise means and how it can be translated to mathematical language with numbers and symbols”.

I asked Linda if she meant text exercises, to which she replied no and I asked her if she could give an example of what she meant by “word-based exercises”. Linda gave a simple example on how she would use this method taking multiplication as an example as a concept she is to introduce. Linda stated that she would start with giving the word “gange” and explaining the definition to what multiplication is in the support languages, then how the word is conjugated. Then she would give the mathematical symbol that is used during multiplication, Linda was aware of the fact that some countries use different symbols in calculation and therefore always likes to ensure that every pupil is clear on what symbol is commonly used in Norway.

Linda then explained that she would take in use of the multiplication table as a source to make her exercises in Norwegian. She makes sure that the pupils have knowledge on the multiplication table before she gives them a word-based equation for applying multiplication. That word-based equation would look something like “hva er åtte gange tre er lik” and “elve gange ni er lik”, then the pupils would have to decipher and write in numbers and symbols before getting to the calculation part of the equation.

Seeing how the first phase has the main focus on language and the learning of mathematical terms, Linda proceeded to explain how the second phase is where all the concept practice and understanding resides. The second phase Linda stated is when the students get to fully practice the mathematical concepts by using both word-based like in the first phase and numerical exercises from the workbook as well.

“By the time we move on to working with exercises from the workbook most of the pupils are capable to both decipher word-out the exercises and solve the

calculation generated from those exercises. So, in this phase we give them time to practice and perfect their skills in the topics while we (Linda and her co-teacher) go around and either help or answer questions. This phase is very important for when we get to checking the kids' knowledge later in the last phase."

Moving on to the third and final phase of the system is when Linda and her fellow teacher want to check the knowledge of the pupils. Here Linda explained that since they are responsible for both teaching Norwegian and Mathematics in the reception class it is important that the test used should include questions for testing the pupils' understanding of the mathematical language and the applicability of it. In the attachment (CHOOSE PART) it is possible to see an example of a test that Linda had used in her class when taught geometry. When asked to further elaborate on the reason why Linda had adopted this method of assessment, she pointed that her main goal as a mathematics and Norwegian teacher is to get the students to be able to solve the given equation while being able to express the answer alongside with their thoughts behind it. *"I feel like as math teachers it is important that we look at the calculations that the kids do when they do math as much as it is important to check if they can express themselves and explain what they are doing."*

Linda talked more about the different parts of the test where its about defining the topic term and explaining it in their own words and drawings, she explained that because of the nature of reception classes they are unable to focus entirely on the application of mathematics rules. "Because we have children from different ages in one class, we can almost never test their knowledge on applying a topic, and we usually check their ability to know what the terms mean.". During the test the pupils get Norwegian words that they have to translate it into mathematical language, Linda explains. In the attachments we see an example of such practice of assessment (CHOOS PART).

"it's not just about translating, we want to give the children an opportunity to express all the knowledge that they have on this topic using drawings, definitions or the context the term is used in, all I permitted as long as they use mathematical symbols in their answers."

There are many important sides to teaching multilingual pupils mathematics in another language than their first, but one of the most prominent aspects for Linda is their motivation

to learn. Linda explained that many children and their parents come to Norway with the mindset that learning a new language is a simple process that, on the contrary, is actual quite complex. This gets easily reflected onto their attitude and approach when learning subject language (fagspråk) in class.

“they want to talk with their peers from general classes, but when they fail to do that they complain that they are not learning the same speaking habits as the others, the children want to learn slangs, but what they don’t know is that there is a difference between the tone and words they can use in a conversation with their peers, conversation with adults and the words used in subject language”

Another aspect that Linda explained is important when teaching mathematic in Norwegian to multilingual pupils revolves around the pupils’ expectations for and understanding of what learning mathematics in another language actual entail.

“what we actually learn in mathematics class is not only the rules in the topics and their application, we learn the Norwegian mathematical language, but the students here often stop doing exercises when we work with topic that they have learned in their home countries because they have already leaned it, but the goal with relearning those topics is to learn the mathematical language in Norwegian”

When asked about the challenges of teaching mathematics in reception class, Linda mentioned the variation in the number of children in her class throughout the year. In the beginning of her interview, Linda have explained how the number of students in her classroom has not been the same throughout the school year. She explained that she had students starting in her class at different points of the year, and because of that she had to alter the course of her teaching.

“When new students start with us, we would have to adjust the tempo we are working in because I would have a lot of my attention taken from the other students and put on the new student this would cause.”

5 Discussion

As previously mentioned in the methods of analysis, the answers of the three teachers were put into two categories for answering the thesis. In the first category, I will discuss the teaching methods that they used, while in the second one I will discuss about the challenges of teaching mathematics in those classes. The results from the interviews were cross analysed with each other in relation to the mentioned categories and this gave source for several interesting notations that will be presented in this section of this paper.

In the first category, I will be discussing the different teaching methods and comparing how the different methods are being used in the classes of the three teachers. I will be drawing on the causes for those differences ranging from number of students, the diversity of their languages and their academic level in mathematics. In the second category, there will be a discussion of some of the challenges that these three teachers have faced when teaching mathematics in reception and adult education classes. These challenges are ones that teachers were concerned about and that were taken into consideration during lesson planning or while teaching. In their answer they have mentioned how these challenges have affected teaching in the subject and therefore these affects will also be discussed alongside the challenges.

An important aspect to point out here is that the following methods and concerns are ones that the teacher has mentioned in their interviews and are based on their own experiences.

Therefore, these results apply to the selected teachers that took part in this project but still can be taken as indication for what could be happening in reception and adult education classes. Had the selection for the interview been other teachers than Tom, Nina and Linda, then there could have been a different emphasis on what teaching methods being used and there could be other challenges that other teachers could have faced.

Under each of the two mentioned categories, a multiple of other subcategories have emerged, these subcategories will be introduced and thoroughly explained in detail for further discussion on the results.

5.1 Teaching Methods

The first of the categories for analysis; Teaching methods, the interviews have given rise to four subcategories that summarise the different approaches each of the teachers took in their classes. These subcategories are *adaptations to the teaching, the use of representations, translations between first language and the language of learning, and developing subject-specific language*. When cross analysing the data acquired, the methods from the interview subjects will be discussed in depth and with examples of relevant practices of the teachers.

5.1.1 Adaptations to lesson planning or teaching

All the teachers in this project seemed to be aware of the barriers that languages create between multilingual individuals and learning mathematics. The teachers have therefore expressed the need to alter and accommodate their teaching so that the students acquire the knowledge that is necessary for them to learn. The teacher seems to have knowledge of different teaching methods that correspond to these ever-growing needs that the language barriers issues create in the classroom.

Gathered from the interview subjects, all the teachers are aware that the pupils in their classes are of different levels of knowledge on the topics in mathematics. The teachers have shown in the interviews that they have the need to differentiate their teaching to accommodate to the students' level in the subject. Both Linda and Nina have expressed that since they work in reception classes, they get students that are on different ages and grades and therefore also different levels of mathematical understanding. Even if those students are of the same grade and age, their knowledge would still differ depending on the schooling they have received in their home countries.

Nina, Linda and Tom have expressed that they must work with the students in smaller groups to understand the extent of their knowledge and help them develop their knowledge. Both Linda and Nina sorted their students into smaller groups after they mapped the levels of the students. In Nina's case, she took the approach of creating homogeneous sitting groups of 4 students in each group based on the student's mathematical levels of knowledge. Whereas Linda sorted them based on the common languages that they speak. On the other hand, Tom sorts his student into groups with the same first language. It was not clear from the interview that he considered knowledge-level based distribution of his groups.

«Opplæringen må være nivåbasert og gis ut fra elevens faglige ståsted.» (NOU 2010: 7) this entails that the pupils need to get teaching that is more compatible with their knowledge level in a subject before they can advance in term of learning. Both Linda and Nina have voiced their concern that the pupils in their class are of different level in mathematics and have taken action to help their students by initiating peer learning with closer teacher follow-up. This they have explained, comes with the responsibility to accommodate the learning methods for them.

In the interview with Tom, he expressed that he uses peer learning as well. He uses this method mostly for making his students discuss the mathematics taught. Tom explained that his goal is to get his students to understand mathematics and so he uses the groups as means for them to be able to discuss it with others. His use of peer learning using first languages acts as a tool to help make mathematics more understandable since the students are sharing the same language. Tom would get his students to explain subject topics to each other using their first languages, which seems to be effective to ground the information in the minds of the learners. An important side to using peer learning is that the altered version to use of students' first language seems to give opportunities for more subject-related discussions, but up until the discussion is not on math and rather switched to something else. This is one of the challenges that Tom mentioned in his interview and will further be discussed in a later category related to the challenges of the teachers.

5.1.2 The use of representations when learning

As Linda and Nina has pointed in their interviews that they have pupils who face learning difficulties caused by language barriers in their reception classes. It is possible to see from Nina's interview that as she was pretty concerned for the pupils' understanding she resorted to hanging posters of the mathematical shapes in her classroom and in her presentations, as seen in attachment number 3 and figure 2. Nina has her students make drawings when starting to learn om geometry, where the aim is to first learn the names of the shapes. In Tom's case, he did not use visual representations in the same level as Nina and Linda did. On the website where Tom showed me the lists of glossaries, there were subject terms that had drawings included. Tom did not imply specifically that he would show those drawings when teaching, but when talking about them he showed an appreciation for them. He had mentioned that when he teaches Norwegian that is when he indeed uses pictures to help his students learn the

new vocabulary better. It is in this aspect that Tom uses visual representations differently than what Nina and Linda have done in their classes.

The approach that Nina has taken was to create external visual representations to take a load off the students having to internally visualize the geometrical shapes. This method for giving visual aid to provide a less cognitively challenging learning environment corresponds with Matheson and Hutchinson's (2014) theory on visual representation as a method for organizing data and information for the learner.

In Matheson and Hutchinson (2014) reference to Van Garderen and Montague (2003) they explained that **“good problem solvers usually construct a representation of the problem to help them comprehend it”** (Matheson and Hutchinson, 2014). Here, in this article, it seems that the good problem solvers are the ones that get good use of the representation in mathematics, but the interesting part is that they promote the use of this method with students who have learning difficulties for the purpose of understanding the problem at hand better. This purpose is a universal aim of all teachers who work with mathematics and so this method can be utilized for understanding mathematical problems even for those who do not have learning difficulties nor are as good with problem-solving as explained in Matheson and Hutchinson (2014).

In this section the focus was in showing the representations that teachers make use of when teaching mathematics. From the interviews, it was gathered that the most used form for representation was visual representation. The use of visual representations has differed between the teachers, in Nina's case it was to understand the mathematical concept at hand. With Linda, it was to gather and test the students' knowledge on the topic while Tom did not focus specifically on visual representations, but he regards them as useful when they come in the glossary lists he hands out to his students. One thing to be remarked is that there can be other forms of representation that multilingual teachers might use when teaching in reception and adult reception classes than the ones shown in this section. Here, the only form for representations gathered are visual drawings and pictures in mathematics.

5.1.3 Translation between the first language and the language of learning

In Tom's case, he reported that he relies heavily on the translation of topics taught between the students' first language and Norwegian. Reading from his interview it seems that he is

aware of the difficulties that text-based problems impose on his students. His method for approaching the situation is by facilitating an understanding for the context of the exercises before he can go over to the arithmetic part. There he would go through the calculation that takes place after he introduces, works with and establishes an understanding of words in the text in the exercises. Smit (2013) explained how teachers in multilingual classrooms tend to do the contrary of what Tom is doing. “A common teacher practice is to avoid linguistic aspects of teaching, for instance by decontextualizing context problems and avoiding time-consuming verbal interaction.” (Smit, 2013, s. 46) . This has Smit (2013) recognized this as a substandard teacher practice, reinforcing that Tom’s practice has a positive impact on the students. Smit (2013) explained that teachers who avoid dealing with linguistic and verbal parts of mathematics will give basis for challenges for the students when learning rather than promote their learning.

Much like Tom, Linda has does also depend on translations between Norwegian and her chosen support languages (støttespråk), but with her she has a system where she consciously works with these languages. Linda’s system is mapped in a way to cover a whole topic and can be reused with every new topic introduced, but rather than repetitiveness Linda’s system provides a structure for learning. In correspondence with Collier’s (1995) theory on quality bilingual program leading the students to better and faster cognitive and academic growth as explained in the theoretical background. It seems that Linda is working towards achieving better learning outcomes for the students. Linda would work with explaining mathematical formulas in both Norwegian and the support languages. With this method, Linda enhances the students’ knowledge of the different mathematical topics while working on their understanding (using the support languages) and their ability to express their knowledge on those topics (by learning mathematical terms in Norwegian).

Having the students meet with words text on a constant base, where they have to read text, understand context, decode mathematical problem, construct and solve the problem and lastly present the solution are essential skills for any citizen participating in this globalized world. Serafini (2012) on Luke and Freebody (1999) definition of reader as “text participants to include participation in understanding and composing meaningful written, visual and multi-modal texts.” (Serafini, 2012, 157), relates that pupils have to carry out these steps “in relation to their available knowledge and their experiences of other cultural discourses, texts and meaning systems” (Serafini, 2012, 157). So, this discussion shows that they have to get in contact with and use previous and current knowledge to build a wide enough repertoire of

tackle to successfully engage in solving word problems in mathematics. This supports Linda's practice of terms understanding in one language and then using the same terms in an example or redefine them in Norwegian.

Translating and switching between the practice and application of mathematical concepts appear to be a fruitful way of employing the multitude of languages in his class. In accordance to Moschkovkovich & Nilson-Barber (2009) regarding a study on bilingual adults when solving word problems (Qi, 1998) is that switching between their first language and language of learning has "facilitated rather than inhibited solving word problems in the second language" (Moschkovkovich & Nilson-Barber, 2009, s. 123). This indicates that the method of going through text exercises that Tom have been using is of good to his students and would strengthen their vocabulary and help contextualise the mathematical concept thus giving better opportunities for understanding.

5.1.4 Developing a subject-specific language

Generally speaking, research has discussed that teachers should provide for content-based language instruction, Brinton, Snow & Wesche, (2003) argue that teachers throughout the curriculum need to be prepared to teach content effectively *while* developing pupils' language ability. In Smit (2013) it is established that such approaches to mathematics education, happen to facilitate moments in the lesson for the pupils to be focused on the learning and using relevant subject matter terms. This is believed to positively influence their learning outcomes in a topic. This approach creates better opportunities to develop the required content-based (subject specific) language, and as a result of which mathematics lessons can become more accessible and within the reach for all pupils to get better understanding on.

Nina seems to like to give her students the opportunity to use Norwegian to talk with each other on the topic in her mathematics lessons. Nina mentioned that she would rather have her students sit in groups with others of the same level of understanding in the subject. Her goal is for her to help the students understand mathematics and encourage them to use Norwegian to talk with each other. Nina mentioned that she would provide opportunities for translation of subject matter terms at the same time as she emphasizes on the importance of the students communicating in Norwegian. This corresponds with the students' needs for customized

teaching established by the department of education and Brinton, Snow & Wesche's (2003) approach of developing the pupils' language ability.

From Lind's interview he practices for appropriate subject-specific language would be seen where she would introduce subject matter terms in Norwegian and use support languages to make up the definitions of these words. As though building on McKeown's (1993) notion for effective definitions when learning words and terms in a second language, he indicated the required attributes of being clear, short, and familiar. This was clearly reflected in Linda's approach to using support languages, ergo languages that the pupils are most familiar with, when working with new terms and understanding of their meaning. This method that Linda has used in her initial phase, corresponds as well with Nation's works. In Nation (2003) citation of their previous work Nation (2001) "When the use of an L1 translation is combined with the use of word cards for the initial learning of vocabulary, then learners would have very effective strategy for speeding up vocabulary growth (Nation 2001: 296-316)" (Nation, 2003, s. 4). This shows that the use of first language (L1) is an effective leaning method when learning vocabulary.

5.2 Challenges of multilingual mathematical teaching

The second category for analysis in this part is the challenges that multilingual mathematics teachers face regarding teaching mathematics in reception classes and adult education schools to multilingual pupils who newly came to Norway and have to yet learned the language. This category gave rise for four subcategories for analysis; *Time management* and *resources available* as well as *class size and class composition* and *managing expectations*.

5.2.1 Time management

All the teachers interviewed mentioned the aspect of time when asked about the challenges that come with teaching mathematics in both adult education schools and reception classes. Tom for example has commented that the tempo in which is established in his classroom when working with the curriculum is much slower than he wishes for it to be considering the amount of content that is expected for him to cover in a year. Here, Tom has alongside time management mentioned the high expectations that are laid on the level of mathematical competency that his students are to have by the end of the school year. This matter is not

solely confined to only Tom, but the other teachers have also expressed the same and therefore this issue will be discussed in more detail in a secluded segment for managing those expectations.

This awareness and management of time has surfaced with Nina and Linda as well. This issue was unveiled mainly when they were talking about their methods of working. Nina has commented that despite trying to cover as much as she can of the curriculum in mathematics it was not possible to do so while maintaining her method of repeatedly working in small groups with the students. Therefore she opted to rather teach the essential topics because she must set aside more time on the explanation and understanding of mathematical content in reception classes more than she used to do when she worked on reception classes.

Linda as mentioned earlier was almost in tow with the same reasoning of Nina and Tom where she too has also been a victim of time and the amount of curriculum that needs to be taught. All the teachers in this study have expressed their frustration over not having enough time to truly give the students the education needed to match their peers. Here it was clear that what the teachers have been experiencing is relevant to Collier's (1995) theory on the length of time non-native speakers need in bilingual programs to have the same level of school performance. The reality of most reception classes is that students get education on Norwegian language and the other subjects in the school for a short period of time, ranging from 6 months to one year, before they get moved to regular classes.

This practice contradicts with the ideas that Collier (1995) presented on non-native student and the length time needed in special programs before they have the same level of knowledge, in a subject, as their peers have. Through his research Collier (1995) found out that the range of time that these students take to get enough knowledge to be on the same level of their peers is much larger than what is given in reception schools in Norway. Collier (1995) argued that the reality is that students can take up to 10 years in worst case scenarios where the learner has not had any schooling priorly, and as little as 4 years if the learner had received education in their home countries. Therefore, the time limit of one year at most creates challenges for the teachers to try to work with and guide their students through.

5.2.2 Resources available

Resources are a vital part of teaching in schools concerning the learning strategies of the pupils. Strandkleiv (2006) listed the learning strategies that teachers should engage the pupils in to achieve learning, those strategies are visual, auditive, tactile or kinesthetic (s.15). With that concept in mind, it is important that teachers are provided with appropriate artefacts and resources that facilitate better learning environments and deeper understanding on subject matter concepts. Nina showed awareness of this fact when she mentioned the use of drawings in her classroom. Nina is a teacher with many years of experience so even if it was her first year teaching in reception classes, it was evident that she aimed to facilitate a better understanding of the topic “geometry” by establishing an understanding of what the shapes are while using varied sources for information. Instead of showing and telling the students what the shapes and their characteristics are, she opted to rather having her students draw and color in the shapes, and subsequently get familiar with the characteristics of each shape. This, she explained, led ultimately to securing a level of familiarity and mastery for the shapes, their names in Norwegian and the special qualities that they possess. In this way, Nina has paved the way into possibly understanding the mathematical formulas that belong to each shape. She would then explain the applicability of these rules in exercises after securing a common understanding of the terms and geometrical shapes. She aspired to create a shared culture of learning and understanding that gathers the pupils within the same frame of understanding of information for the formation of similar learning outcomes.

Another useful resource that all the teachers seemed to incorporate and use in their teaching is having a glossary of terms for the topics taught translated from Norwegian to the individual students’ favored language for learning. In Tom’s situation, he uses lists of glossaries available from Oslo Met university to provide his pupils with subject language terms in both Norwegian and their favored language of learning, whereas Linda and Nina had their pupils writing theirs. It was not clear from the interview, but it was clear that both teachers did not know about the lists being available to use. Nina has mentioned that she provides correct subject term glossaries in Arabic, English and Norwegian to the students, and encouraged them the others to do the same in their first languages. Linda does the same as well, she gives correct subject terms translations in Russian, English, Spanish and Norwegian and encourages the other to do the same in their first languages. Both teachers mentioned that they wished there was an alternative way to have correct translated glossaries of the mathematical terms in the languages that they do not master so the students can take use from rather than translating on their own accord. Linda and Nina have had students trying to understand the mathematical

terms through translating them using google translate which not always provide the most accurate translations.

This aligns with the teachers' idea of giving language support in accordance to age/ maturity level, "the older the learner is the less language support they would need, and the younger the learner is the more focus we give on learning with language support which is going to be more beneficial for them"

5.2.3 Class size and class composition

There are many variables that needs to be taken into consideration in regard to teaching multilingual pupils mathematics in a language that is not their first language. One of those variables is the size of the classroom, as in the number of pupils that are receiving education in one classroom setting. As formerly known, there is a correlation between class size and student achievements where it is proven that the more reduced the class size is the higher the achievement of the students will be (Odden (1990), Rice, J. K. (1999)). The way to deal with that occurring issue is to take into account the use of extra adults (Blatchford, 2003) where the whole ideology is helpful because it revolves around heightened opportunities for "teaching interactions and individual support for pupils" (Blatchford, 2003, s. 90).

This aspect has been first highlighted by Tom where he was talking about the differences he has met with when working with groups of students of different sizes. He is a firm believer that the less pupils he has in the classroom the more he can give help, but the prospect of teaching mathematics to multilinguals in a language that is not their first adds another variable to the equation. "When it comes to multilingualism, it is very nice to have participants who know the same language in the same group/ class" was Toms explanation to how he approaches this matter.

The efficiency of Tom's small group approach relies on having multiple students that speak the same language together in one group, that way if there is anything that one student is having trouble, then the others can help out. Later when interviewing Nina the same method appeared in her answers, she often would have students that speak the same language sit together when having group exercises. While talking about small groups Tom had an interesting comment about bigger groups as well,

“It can always be nice with smaller groups, it is very positive to have others present who speak your mother tongue and if this is impossible to achieve that in a small group, if there aren't others with the same mother tongue, it may be more instructive to be in a large class where you plan the class somewhat deliberately based on language groups.”

5.2.4 Managing Expectations

An aspect that came into consideration in the interview with Linda is the expectations that the students and the parents have on her and the school and expectation she has on her from the education system regarding the student's academic progression in reception classes. These expectations she mentioned that are put on the teachers would come to class and affect the pupil's attitudes towards the subject taught. The Directory of Education in Norway clearly states that students would be in reception classes for about 6 months to a year before they are expected to transition to ordinary classes. “Nyankomne elever forventes ofte å følge ordinær undervisning etter relativt kort tid” (NOU 2010: 7). The period of time that is needed for non-native student to reach the same academic level of understanding as their peers in ordinary classes has been studied by Collier (1995). This study that Collier (1995), explained in the theory part, have proven to not sufficient even if the student had received many years of formal education in their home countries.

These expectations can and will have an impact on the learning outcome, so educators should catch onto and try to change if there are any misconception in them. In Linda's case, she was met with the student's expectations to learn Norwegian and be able to communicate with their peer on their same level of linguistic abilities. This problem shown is not only with the student but with their parents as well. When the parents get information that their children are to be in reception classes and would then be then transferred to ordinary classes by the start of the next school year this would place expectations on the teachers to fulfill. Linda's approach to teach mathematics demands that she starts with the learning materials in the student's first language and then transition to teaching about them in Norwegian. This means that the students are met with somethings they already know, and this creates a frustration on their part that they are not advancing in the tempo that they wished for while they are unaware of the pedagogical benefits of this method.

6 Conclusion and Implementations

6.1 Conclusion

In this research paper the idea was to analyse what learning methods are used with their students of multilingual backgrounds and what the effects they have upon their learning and understanding of the mathematical language. The selection of this research group have been teachers in Norway that teach multilingual students in reception classes and adult education schools. These teachers have been interviewed in regards to their teaching methods and the acquired results show some of those methods that their students seem to benefit from. The three teachers in the study show that they make adaptations to the lesson planning and teaching, use of representations when teaching provide translations between the students' first language and Norwegian, and lastly they help their students develop subject specific language using groceries and terms translations using the students' first language.

Some adaptations that the teachers have used in their classes is working in small groups either distributed starting from the level of knowledge that the students possess or by which language they speak. Another example of the adaptations is the use of day-to-day language in teaching. Teachers in reception classes and adult education schools cannot expect that the students know all the all the words yet and some common words may tend to be difficult for some students to understand so the teachers need to take time from teaching mathematics to explain those words. Therefore the time span given for the students to learn mathematics is shorter than what is actually needed, that is one of the challenges that the teachers have faced teaching multilinguals in reception classes and adult education schools.

Alongside the teaching methods that have been uncovered from the teachers there was challenges that they have expressed made their job harder. When these teachers have to teach non-native students mathematics, they have to rely firstly on their first languages for learning and then they need to steadily increase the use of terms of the subject in Norwegian to increase their knowledge on the subject. Some of the other challenges that have been mentioned were time management, resources available, class size and class composition, and lastly managing expectations. Teachers in reception classes and adult education schools tend to have different uses for the teaching methods than in ordinary classes.

Although learning mathematics in another language that is not the students first language come with its challenges, the teachers can use teaching methods that can make learning less cognitively challenging and help them acquire better results for learning. The teachers in this research each have their own use and twist on the teaching methods, and this reflects their understanding of the needs of their students. Therefore, it is important that teachers not only are aware of the strengths and the weaknesses of their students but also both their linguistic abilities and academic level so that they can adapt their teaching starting from the students' standpoint.

6.2 Implementations

There is no definitive answer to how working with non-native students that newly came to Norway nor is there a specific method on how to teach them school subjects. The results from this paper are presented with the aim to set sail to thoughts on how teaching mathematics is in some reception classes and adult education schools in Norway is. This research was done to shine a spotlight on the practices of those teachers in their classrooms and use them as sources to inspire other teacher to reflect over their own methods and practices.

Yet there were some methods that shined through from the interviews that can be taken into consideration for a better teaching in reception classes and adult education schools is to reconsider the period of time that the students stay in these types of classes. A longer period of education in reception classes have been proven to be more beneficial for the students' overall learning. In this way the teachers can have enough time to strengthen both their Norwegian language and build up their academic levels in the school subjects and bot only mathematics.

Another aspect that is considered to have great impact on the subject matter understanding of the students in mathematics that teachers can have control over is the process of learning subject terms in the subject. Here the teachers can use glossaries of terms that the students can have in both Norwegian and their first language. These terms definitions and translations would strengthen both their understanding of the topics and their ability to express their knowledge easier if they know the right meaning and use of those terms. Therefore, teachers need to make sure that they have glossaries with translated definitions of term in both Norwegian and the students' first languages.

7 Further research

Under the theme of multilingual teaching in the Norwegian context, this research paper has the potential to undergo further research evaluations to enhance the validity and reliability of the claims it concludes with. The body of the analysis took shape based on the data collected from the interviews, for this type of research it would be beneficial to have multiple other interview subjects from different education sectors than the three presented. The advantage of this will be having more answers that can be cross analysed and ultimately lead to a more generalizable conclusion that can stretch further than qualitative nature of this research.

It is also possible with the aid of other research methods to deduce a more ground rooted conclusion to the exhibited thesis question. To achieve this, it is possible to analyse teachers' scaffolding methods directly in the classroom with observations and video recordings. This way it becomes easier to compare the data derived from interviews with examples of the interactions from the classroom. Another extension to this research that can be done is to observe and document the progression of students in a reception class in ordinary classes and in adult education schools over a longer period of time, for example a semester or a whole year. Here the methods of teaching will be compared and the different approaches to the use of languages can be sought after and documented before they get analysed to check the learning outcomes that these teaching methods had on the students.

Another long period research can possibly be done in relation to this project is to measure the presents of scaffolding, in regard to the use of other languages, has on the progression of the students' subject matter understanding on a certain topic while comparing it to another class where support using other languages was not present. It is interesting to remark the used strategies of scaffolding and the degree of engagement and effects of these strategies has on the students' understanding compared with another class that did not have the same strategies for learning mathematics. The possibilities of what to study are multiple, another aspect could revolve around the level of understanding within the students supported by various methods for scaffolding and the effects of that if the teacher reduce their reliance on as much scaffolding as the times goes by.

As mentioned in the introduction an interesting aspect related to this topic of research is if these same methods discussed in the results section can be of relevance to immigrant students in ordinary classes. These immigrant students are ones that can speak multiple languages

including their first language and Norwegian but are not on the same level as their classmates and peers.

Investigate how the students function after they have finished from reception classes, whether they have learned what they were supposed to learn in order to have enough knowledge to function well in ordinary classes is an important aspect of reception classes that can be investigated further. This is important to know what teachers may perceive as most important in reception and adult education classes is learning Norwegian, learning mathematics in Norwegian or learning mathematics in the mother tongue and then learning in it Norwegian.

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9 Attachments

9.1 Interview guide used with the teachers:

Introduksjonsdelen:

- 1) Hvor mange år har du jobbet som tospråklærer i matematikk?
- 2) Hvor har du jobbet som tospråklærer? Barneskole, ungdomsskole, videregående eller voksenopplæring?
- 3) I hvilke(t) språk har du selv fått opplæring i da du utdannet deg i matematikk?

Hoveddelen:

- 1) Hvilke undervisningsmetoder bruker du i din undervisning?
- 2) Hvordan har du arbeidet med faget ved å bruke begge språkene?
- 3) Hva er fordelene i en matematikk undervisning på norsk og arabisk?
- 4) Hva er mest utfordrende med matematikk undervisning på norsk og arabisk?
- 5) Hva kan du si er en felles utfordring for arabisk talende elever når de lærer matematikk?
- 6) Må du gjøre noen endringer i måten du presenterer et tema på når du underviser arabisk talende elever sammenlignet med andre norsk talende elever? Begrunn svaret ditt.
- 7) I hvilken grad har du tenkt gjennom hvilke ord du bruker når du skal undervise matematikk til arabisk talende elever? Begrunn svaret ditt.
- 8) Når bruker du arabisk og når bruker du norsk? Hvor mye av hver? Timing?

Avslutningsdelen

- 9) Hvilke sektorer synes du bør ha mer tospråkliglæring i matematikk på norsk og arabisk? (eks. barneskole, ungdomsskole, videregående, mottaksklasse, voksenopplæring) hvorfor?
- 10) Hvilke sektorer synes du bør ha mindre tospråkliglæring i matematikk på norsk og arabisk? (eks. barneskole, ungdomsskole, videregående, voksenopplæring) hvorfor?
- 11) Hvordan synes du at tospråksundervisning kunne videre utvikles og arbeides med i framtiden?

12) Hvis du skulle trekke ut tre ting som du mener er det viktigste vi har snakket om, hva ville det vært?

13) Er det noe mer du vil si eller legge til?

9.2 Consent form presented to the teachers:

Universitet i Oslo / 10/01/2023

Vil du delta i forskningsprosjektet «Flerspråklig i matematikkundervisning»?

Jeg er en lektorstudent på siste året i utdanningen i Universitetet i Oslo og holder på med et forskningsprosjekt til masteren min. Jeg har valgt å sette søkelys på hvordan læreren bruker både norsk og arabisk i matematikk undervisningen og hvilke effekter det har på arabisk talende elever.

Med dette skrevet ønsker jeg å spørre deg om du vil delta i prosjektet, og videre vil du finne informasjon om hva det innebærer å være en deltager på dette prosjektet

Formål

Formålet med mitt prosjekt er å undersøke effektene av flerspråklig undervisning i matematikkfaget. Jeg ønsker å lære mer om hvordan vi kan benytte flerspråklig undervisning slik at arabisk talende elever kan bedre tilegne seg faget. Jeg ønsker å intervju deg om:

- 1) Begrenses arbeidet med matematikk av språket brukt i undervisningen?
- 2) Fremmer læring ved bruk av elevenes førstespråk (arabisk) læringen av matematikk?

Formålet med intervjuet er å forstå dine behov og ditt syn på temaet, slik at jeg danner et bedre bilde av hvordan tospråklærere benytter seg av første språket til elevene i undervisningen sin for at de best mulig tilegner seg matematikk faget og får dypere forståelse av faget

Deltakelse

Du blir spurt om å delta fordi du faller innenfor min målgruppe, definert som flerspråklig lærer med relevant utdanning innen matematikkfaget. Dersom du velger å delta ønsker jeg å benytte lydintervju av deg i min datainnsamling. Intervjuet vil vare i 30 minutter og jeg kommer til å gjøre et opptak av lyd, samt ta enkle notater fra intervjuer.

Frivillig deltagelse

Det er frivillig å delta i mitt studentprosjekt. Du kan når som helst avslutte intervjuet eller trekke tilbake informasjon som er gitt. Du kan når som helst velge å trekke samtykket uten å måtte oppgi grunn. Dersom samtykket trekkes vil eventuelle personopplysninger som er innsamlet om deg slettes og det vil ikke innebære noen negative konsekvenser for deg at du velger å trekke ditt samtykke.

Personvern: innsamling, oppbevaring, behandling og bruk av dine opplysninger

Ingen sensitive personopplysninger (jf. Personvernforordningens artikkel 9 og 10) vil bli innsamlet. Personlige opplysninger om deg vil kun benyttes til formålene beskrevet i dette informasjonsskrivet. Jeg behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

Personlige opplysning innsamlet i opptaket vil bli anonymisert i transkriberingen og rapporteringen senest 1 juli; ingen andre enn jeg, ei heller min veileder Helmer Aslaksen, vil høre lydopptaket eller få vite hvem som er blitt intervjuet, og det som oppbevares av anonymisert rapportering fra intervjuet vil følge Universitetet i Oslo sine rutiner for sikker oppbevaring.

Navn og kontaktinformasjon erstattes med pseudonymer. Intervjuet vil kun behandles og transkriberes av meg og kan ettersendes deg ved ønske. Dataen som oppbevares, inkludert anonymisert data, vil ikke bli publisert og vil heller ikke kunne tilbakeføres til deg.

Hva skjer med innsamlet data når studentprosjektet avsluttes?

Alle notater, opptak, transkribering og opptak av lydintervju blir slettes senest 1 juni. Dette gjelder også anonymiserte og aidentifiserte opplysninger om deg.

Rettigheter

Vi behandler opplysninger om deg basert på ditt samtykke. Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg, og å få utlevert en kopi av opplysningene,
- å få rettet personopplysninger om deg,
- å få slettet personopplysninger om deg, og
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger.

Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

- Hiba Alkadi (Student) epost hiba-alkadi@hotmail.com eller tlf.nr. 96744439
- Helmer Aslaksen (Veileder) epost helmer.aslaksen@gmail.com 46234554
- Roger Markgraf-Bye (personvernombud) epost personvernombud@uio.no

Før intervjuet begynner ber jeg deg om å samtykke i deltagelsen ved å undertegne på at du har lest og forstått informasjonen på dette arket, og ønsker å stille opp til lydintervju.

Med vennlig hilsen

Hiba Alkadi

(Student)

96744439, hiba-alkadi@hotmail.com

Med vennlig hilsen

Helmer Aslaksen

(Veileder)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om forskningsprosjektet «Flerspråklighet i Matematikkundervisning», og har fått anledning til å stille spørsmål. Jeg samtykker til:

å delta i lydintervju

Jeg samtykker til at mine opplysninger behandles frem til studentprosjektet er avsluttet.

Sted og dato

Fullt navn

Signatur