Practical and aesthetic subjects as tools to vary the mathematics education

A minor field study of mathematic teaching at an elementary school in Barbados

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Praktiska och estetiska ämnen som hjälpmedel för att variera matematikundervisningen
En mindre fältstudie av matematikdidaktiken på en grundskola på Barbados

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Abstrakt
Studiens syfte var att undersöka om hur praktiska och estetiska ämnen kan stödja i matematikundervisningen. Undersökningen gjordes genom intervjuer och observationer på en grundskola i Barbados i fyra olika klasser, detta för att också få en uppfattning om hur användningen av dessa ämnen kan variera i de olika årskurserna. I studien behandlas vad praktiska och estetiska ämnen är och hur viktiga de är att integrera i matematikundervisningen för elevers inlärning, förståelse och lust att lära. Dessutom granskas lärarnas attityder till dessa ämnen som stöd och hur de förhåller sig till dem i sin undervisning.

Nyckelord
Praktisk matematik, lusten att lära, ämnesintegration, estetiska läroprocesser, Barbados, inlärning

Abstract
The purpose of this study was to investigate how practical and aesthetic subjects can be used to support the mathematics education. The research consists of observations and interviews in four classes at an elementary school in Barbados to get an understanding of how the use of these subjects also can vary between the different ages. This study consider what practical and aesthetic subjects are and how important they are to integrate into mathematics teaching for students' learning, understanding and desire to learn. The teachers' attitudes to these subjects as support and how they relate to them in their teaching will also be considered.

Keywords
Manipulative mathematics, desire to learn, subject integration, aesthetic learning processes, Barbados, learning

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1. Introduction

In 2012 I and two friends received a scholarship from the organization Sida, which made it possible for us to travel abroad to do the research for our essays. We decided to go to Barbados for nine weeks to investigate the mathematical education through observations and interviews. It was an interesting and giving opportunity to take part of their educational system and culture, the results of my study will be presented further on.

In this thesis I will study the mathematics teaching design in different grades at an elementary school in Barbados, with a focus on how and if practical and aesthetical subjects are used as tools to vary the mathematic lessons. Löwing and Kilborn write in *Baskunskaperimatematik*(2002) that you have to individualize instructions since all students are different, and both in what a student is able and willing to learn. They apply the words "ability" and "ambition". These concepts vary between each individual and each must be taken into account in teaching (2002). I want to investigate if a use of the practical and aesthetical subjects makes a difference to the teaching and the student’s education in a positive way.

I decided to write about this topic because of my own curiosity of how the teaching of mathematics can look like and which perceptions the teachers have according learning, understanding and the desire to learn. Mathematics has often gone under the description to be a subject where you only work in a book, a theoretical issue rather than a practical issue, where all pupils with different abilities to learn are not taken into account and where the ambition of those wanting to learn not stimulated (Skolinspektionen 2009). I am as a future teacher of mathematics in primary schools, curious what happen when the work with a theoretical subject is made practical and with aesthetic subjects as tools I question if it affects students' views on the relevance and whether it serves as a tool to promote the learning.

Since mathematics is a topic related to our everyday life, it is also an important topic to understand and learn. The teacher is the most important source of inspiration when it comes to students' attitudes towards mathematics and the teacher should therefore work for the students' desire to learn (Ahlberg&Wallby et al 2000). The teacher must be able to convey the purpose of why, and lift it into something interesting and exciting by de-dramatize the general perception that it is abstract and incomprehensible. Students' creativity and curiosity must be stimulated for it to benefit their knowledge, and to enable them to develop aspirations to want to learn. Practical work should therefore take into account all aspects of teaching, intellectual and practical. I once saw on a poster in a school where I had practiced, the text: "By listening, you hear. By watching, you remember. By doing, you understand". This I have brought with me ever since, and I strive to follow that opinion.

Dahlin, Ingelman and Dahlin (2002) writes that as a teacher it is not enough to have theoretical knowledge, you must yourself be imaginative and creative thinking to turn this knowledge into good and rewarding teaching. You have to have a deeper and more vivid understanding of the theories in order to apply a practical teaching with commitment and presence. And to provide an education for all children, a teacher must pay attention to the sensual aspects of the school. These aspects involve the practical and aesthetic, and are also about a school for all the senses. We teachers must ourselves be fascinated by the subject in order to plan teaching so that the students perceive the subject as exciting and fascinating (2002).
Often mathematics is a clear anchor for everyday life and what you do in real life, although it often disappears and mathematics is made more abstract than needed. For that, teaching should be easier for students to understand. It is required that you yourself possess skills that help to convey the practical implications of these arithmetic operations and then you can connect them to everyday life as it looks now (Löwing & Kilborn 2002).

*Läroplanen förgrundskolan, förskoleklassen och fritidshemmet (The Curriculum for primary schools, preschool classes and after-school) (Lgr11)* says that school education should be adapted to students' individual needs, to contribute to the continued learning and knowledge, that students' curiosity and creativity will be stimulated through active learning with creative work (Lgr11), it also emphasizes the importance of individualized and subject-integrated education in schools, and that it is of great importance to reach each student according to their different abilities and ambitions through very practical work (Skolverket 2011).

I have come to understand that the majority of the public perception of mathematics is that it often is difficult and for many incomprehensible. It is a subject that many either thinks is too simple or too hard and they do not have the understanding. Mathematics should not have to be seen as the boring and unnecessary topic in school and I am interested in how much the teaching can affect these negative feelings among students into be positive instead. Since mathematics is a part of the everyday life, it should be seen as interesting and fun, and I am therefore interested in how the teachers work to show their students that it is necessary and that it does not have to be boring or confusing.

There are many perceptions about how the teaching should look like and how the lessons in mathematic can be planned to enhance the learning, the desire to learn and for the students to get a deeper understanding towards mathematics. I do have a rather good idea of how this looks like in Sweden so I will do my research for this thesis in Barbados to get a wider understanding myself. It is important to say though that I will not do any comparing between the countries. This thesis will be about observations and interviews at a school in Barbados with support of Swedish literature.
2. Purpose and Issues

The purpose of this thesis was to investigate in which ways the teachers work with different materials during the mathematic lessons. The purpose was also to investigate how practical and aesthetical subjects are used to enhance the students’ learning, understanding and desire to learn.

With interviews and observations I will see if and how much it can differ between the grades with practical work in mathematics. I also want to see if the general perception of how to teach math varies between the teachers by interviewing them. During this thesis I will use different synonyms to practical mathematics depending on how the authors have chosen to express themselves regarding the subject.

The issues will be:

- In which ways do the teachers work with mathematics during the lessons, and why?
- Which materials are being used?
- Do the teachers integrate any practical and/or aesthetic subjects to the mathematic lesson? Why, why not?
- Do the teachers think that it would enhance the students learning, understanding and desire to learn by using aesthetic subjects and more practical based lessons? Why, why not?
3. Background
This section is a presentation about Barbados in general as well as their school system. Both what we saw during our visit and what we have read at various sources.

3.1 Barbados
Barbados is an island in the Caribbean that is located in the east and the official language is English. The island itself is not more than 430,00km2 and is rated to have the highest GDP (Gross domestic product) in all of Caribbean. The sugar industry has previously been the country’s main income, but lately tourism has taken over more and more. Barbados has a tropical climate with a rain period that reaches from July to November. In the end of summer there is a risk for hurricanes (http://www.landguiden.se/).

Almost all of the population has roots in Africa. Barbados is rated as one of the most populated countries in the world and is under constant development. Today, Barbados is on 38th place of the UNDP’s (United Nations development programme) human development index. This is a scale where they measure the human development in a country by combine the expected welfare, educational level and income (http://hdrstats.undp.org/).

The island have many influences from Great Britain, and is sometimes called "Little England", even the schools have similarities with England. Principals have a high status and education is internationally considered to be very good(http://www.landguiden.se/). Barbados became an independent country at 1966 and until then the island was ruled by the British, although is the British monarch still the island’s domination. The English heritage can also be seen everywhere, which describes the nickname. Some examples of the British influences on the island are that they drive on the left side of the road and the biggest sport is cricket as well as horse racing and polo which also are popular (VerBerkmoes 2008). The culture on Barbados can be described as a mixture of influences from both USA and England and is called “bajan”. Bajan is also a designation to their language which is English but with clear influences of the African. The recording artist Rihanna is from Barbados and is therefore a connection to the American culture as well as the American hip hop and NBA that is also popular on the island (VerBerkmoes 2008).

3.1 The School system on Barbados
There are several reasons to why we chose Barbados for our empirical investigation. It would be interesting to see how their educational system looks like. We knew since before that the country is an old English colony and has a strict form of schooling. School uniforms are used, so that every individual becomes a part of a community. The teachers have authority, a clear leading position that the student respect and considers a good role model. Barbados is a country far away from Sweden and Europe, and therefore we thought it would be interesting to take part off their educational system and see how it works in the Caribbean. The schools consist of British standards and elementary school is free and mandatory, 95% of the children go to school (2008). 99% of the population has reading and writing skills. The schools on Barbados are considered to have a highstandard (http://www.landguiden.se/).

According to observations and discussions with the staff we have come up with the following: The teachers and the principal had a lot of authority, and every time a teacher or the principal entered the classroom, the student stood up and sang a welcoming song. All the children had identical school uniforms except Thursdays and special occasions, where the students had their scout uniforms or specially chosen school uniforms. Despite all these rules, which felt strict from our point of view, the school itself seemed to be relaxed and a fun place for the
students. Also the teachers liked their work place. They had no particular dress code, except that the clothes they wore should cover their body. They were in no means strict or harsh against the students. The principal claimed that these rules are the same on every school in Barbados, but others are stricter, where teachers are obligated to wear suits and the expectations on students are much higher.

It was a small school, which was built out of barracks. There are no closed doors, and every classroom has two big open doors, even if other classes were on a break and were playing outside. During one of the observations in a special class for juniors, a rooster walked into the classroom, and none of the students reacted on it. Their concentration was high even though you could hear the sound of playing children and animals walking around in the classroom. Except the significant differences in appearance of the school, there was a difference in ages. The children start going to school at the age of 3, where they go to a grade that was called ‘infants’. They went there until the age of 6, and then they went on to the next grade which was called ‘juniors’, where they went until the age of 11.
4. Theoretical Background

In this chapter I will bring up previous research regarding the issues I present above. I am going to present the theories about learning, the desire to learn, aesthetic learning processes, subject integration and manipulative mathematics.

4.1 Learning

Dahlin, Ingelman and Dahlin (2002) say that it is important to play for learning for more than one reason. It is a good way of teaching, and it can as well function as de-stressing relaxation. Because a student's memory, concentration and health will not be adversely affected in today's society. Due to stressful situations in school and at home, play as relaxation is essential for some students (2002). With the effect of stress on students' concentration and memory, therefore it is important to pay attention to how lessons are planned to promote student learning in the best way. You have to think about how you can down play the elements of education those students often feel is difficult, to avoid or eliminate stress. It's not just about play that comes out of nothing, it’s about the play to feel real to the student. It should involve both body and mind and be as strenuous in both as when you exercise the muscles of the body and the brain (Dahlin, Ingelman&Dahlin 2002).

“Children’s first encounter with mathematics in preschool and school is important, as it can affect their future attitudes and opportunities to learn mathematics" (Ahlberg&Wallby et al 2000: 9). The experiences of our everyday lives affect our understanding of the world, and depending on how we perceive and understand the situations we are involved in, we create knowledge. By taking advantage of this, and as a teacher relying on students’ prior knowledge, we will create a learning environment that promotes curiosity and thus contributes to inspire knowledge. If you start too early in a mathematics education by exposing students to large, formal equations, then there is a risk that the consequences will be a negative view of the subject, and that students do not understand the purpose or meaning. Understanding, and thus learning, is affected and the students might get the impression that it is all about answering the first and fastest, rather than to understand and try different strategies and modes of expression. With this also takes away joy and curiosity to discover in mathematics, and the opportunities for creativity decreases (Ahlberg&Wallby et al 2000). Sometimes it may seem that we stress upon students an early adulthood, through demands on students to write, read and count earlier and earlier in life. This can damage their mental and physical health, says Dahlin, Ingelman and Dahlin (2002) and then in turn damage the students' imagination and creativity. If we can get the stress out of the schools with the students who start formal education as early as possible, and instead allow them to develop their creativity and imagination, learning will be better once it's time for them to start studying (2002).

The prerequisites to learning well depend not only on mainly students’ knowledge, it also speaks of the harmonious development and a soulful learning. Dahlin, Ingelman and Dahlin (2002) describe how soulful teaching also can encourage students to develop as individuals, something they think is least important for the school to do in order to create opportunities for further learning. If the education gives the students the opportunity to truly be they, they will be soulful and feel that they are talented. In the true feelings of beauty, joy and life soulful teaching can emerge. Children and young people can to develop into (whole) people in a good teaching environment because of the "soul-confidence" that they will receive (2002).

The students who are not given the chance to develop as individuals often do not believe in themselves and their abilities; they feel like failures. They must create meaning and context of
their environment, and these are the situations that apply when they have the math skills to determine how they will think and act (Ahlberg&Wallby et al 2000). To promote learning, students need space to argue and discuss the mathematic tasks they are solving. Therefore it is important to plan the lessons so that it is more focused on the students understanding. Working in this way will lead to growth of the students, where they create faith in their own abilities and faith in their own thinking and mathematics skills (Ahlström 1996).

The teacher's attitude toward mathematics affects student learning at least as much as the education itself. Therefore it is important that you as a teacher reflect on the students’ own approach to the subject and how it differs between them. In order to be able to improve the learning experiences of the students, they must be able to insert mathematics in a meaningful context, for a clearer purpose of why we read mathematics, and to be able to talk about mathematics so the students themselves may think about the topic, and thus find out which approach they have. You must be able to go deeper and find out what lies behind the views that mathematics is fun or boring (Ahlström 1996).

Students learn when they interact with each other in social settings. The use of cultural tools benefits students developing higher intellectual abilities. Students use and develop these cultural and aesthetic tools with art, music, dance and drama facilitating the active processes of teaching and thus contributing to learning. Through these activities, students create knowledge and make the development of their ideas possible. Learning takes place on many different levels, and it is through the overall situation, including, the written, spoken and active together that determine both what and how students learn and apply knowledge (Karlsson 1998).

4.2 The desire to learn
Above I mention the risks of inciting students prematurely into a formal education, and that you should take advantage of their curiosity and creativity to strive to create meaning and understanding. Early in childhood, children in contact with mathematics in their daily lives encounter the aspects of basic math without thinking about it. When they put on their shoes or share their candy with a friend, for example. These experiences contribute to a subconscious knowledge, which then becomes the basis for their continued development of mathematical thinking and understanding in a more formal sense. By nature, children are creative, they are curious and want to explore, and it is through creativity and play that they develop their skills to a mathematical competence. By taking advantage of the students' previous experiences and to let them develop those without the stress to quickly start a more formal teaching, and by giving them new experiences that relate to their world of experience, you will stimulate their desire to learn (Ahlberg&Wallby et al 2000).

In Lgr11 you can read what a Swedish teacher has to consider. The teacher should:

- take into account each individual's needs, circumstances, experience and thinking
- strengthen students' willingness to learn and their confidence in their own ability
- allow for the learner's ability to self-create and use different means of expression (Skolverket 2011: 14).

Since all students have their own experiences and different perceptions of mathematics as soon as they start school, it is important to the teacher to find out these perceptions, and examine how students think about the subject and then find out which learning that is best suited for them. Students must be challenged to make their own discoveries in the subject and create new knowledge. Teaching should involve their experiences, curiosity and knowledge
for them to see the purpose and value of mathematics. In order to be able to do this, one must dare to leave the stencils and the old materials and come up with mathematical activities outside these (Ahlström 1996).

Using the aesthetic subjects together with book topics makes teaching more practical and hence learning more enjoyable. Students grow through art and changing learning skills. Creativity and learning are two concepts that should be considered together, where students can develop spontaneously (Aulin-Gråhann, Persson & Thavenius 2004). For teaching to be perceived as more enjoyable for students, and for it to bring out their curiosity, thoughts and ideas, it is necessary to choose appropriate structures and procedures that meet the purpose of the mathematics that best responds to the objectives and content of the subject. In today's schools, the individual, quiet work, which teaches students to count, dominate but that method does not give the students the opportunities to argue for their ideas and analyze problems. This approach often leads students who have difficulty with mathematics, to not get their needs met, while students who find the topic easy many times do not get the stimulation they need (Ahlström 1996).

The teaching of mathematics should aim to develop students’ knowledge of mathematics and mathematics used in daily life and in various disciplines. The teaching helps students develop interest in mathematics and confidence in their ability to use mathematics in different contexts. It will also give students the opportunity to experience the aesthetic values in meetings with mathematical patterns, shapes and relationships. The teaching is to help students develop skills to formulate and solve problems and reflect on and evaluate the selected approaches, methods, models and results. Students should also be given opportunities to develop skills to interpret every day and mathematical situations and describe and formulate these using mathematical expressions (Skolverket 2011).

The way a student emotionally connects to mathematics is often crucial in deciding how learning is affected, and how materials are used. With this, it is crucial how the teacher works with the substance to arouse students’ desire to learn and develop their views on the subject. You have to talk to students and find out what ideas they have and what skills and experience they possess by working with different methods and activities (Ahlström 1996). Teaching should not be guided by the textbook, it must contain interesting situations that are relevant to the topic through a variety of approaches. Teaching more practical possibilities is greater when you see to students’ different needs. Through social interaction teaching, students will feel that their ideas are respected, and that they will be taken seriously. The students’ desire to learn is characterized by teaching that can convey meaning, to get involved and to choose activities that bring out the excitement in work. By allowing the student to see connections and patterns in different kinds of problems, they will have confidence in their own learning and their abilities and develop a more positive view of mathematics (Ahlström 1996).

One of the main objectives is that the students will develop a desire and an ability to solve problems in mathematics. This occurs where problem solving aims to stimulate interest and thinking in students. Here, solving a problem is developing their thoughts and their confidence, their ability to analyze, to be creative, and their patience. As a result, you learn also how to think logically and to discover relationships. You come one step closer to mathematical thinking. In order to be able to take steps in the right direction, students need to get opportunities to develop their abilities to solve problems in an environment that is both safe and creative (Ahlström 1996). For students to develop these skills it requires not only that the teacher makes sure that it is a safe environment, the teacher must also adapt teaching to
include creative activities for working on solving problems and must vary these activities to
take into account the students’ varying circumstances and interests. These activities can
provide help for other school subjects (Ahlström 1996).

4.3 Aesthetic learning processes
An aesthetic learning process can be described as something necessary to get variation in
learning, and to introduce other new experiences in which all parts contribute to a whole.
Through these processes, it comes in focus, something that is important to clarify what visions
the students have. If you understand what you see, what you see is clearer, and you will learn
more (Aulin-Grähamn, Persson&Thavenius 2004).

When you work with geometric patterns in mathematics, you can easily think of all the
patterns we encounter in our environment, and that we also may be more or less
unconsciously devoting ourselves to. When children string bracelets with pearl beads they
often strive to create a nice pattern. A rag rug or a decoration on a cake is also examples of
geometric patterns we engage and encounter in our everyday lives. Quilts and tennis shoes are
also built on the pattern. Crafts that students often try to do in sewing on patches, is likewise
a practical and aesthetic subject that invites them to think about geometric shapes and
patterns. It is by using this angle for speech patterns, and working with images and geometric
patterns that helps and increases the understanding of the context and how it fits together
(Ahlström 1996).

When we work with spatial awareness in schools, it is important that students have the
opportunity to develop a basic understanding of the concept. Through activities and exercises
that focus on geometric conditions, such as location, view, size and shape of objects, they
explore their surroundings and make discoveries. Children already have visual impressions
from their experiences and see patterns and motion of objects, but you can reinforce them,
and they also make use of the other senses as hearing and touch to enhance their spatial
perception (Ahlström 1996).

An aesthetic learning process with students relates to the outside world and considers how
they gain knowledge about the human, emotional and sensual, and also how they develop
their fantasies and beliefs. They learn these processes also through knowledge of aesthetic
forms of knowledge (Aulin-Grähamn, Persson&Thavenius 2004). One can see the aesthetic
activities as a collective knowledge development training, to develop their identity by
communicating and expressing themselves in different ways, and to concretize what to learn
by doing. What you do will be remembered. It’s about learning how to describe and express
their views, and knowledge is something you build up (Aulin-Grähamn, Persson&Thavenius
2004). If students are given opportunities to communicate with each other and to discuss their
thoughts, they could correct misconceptions. Thus, having communications about
mathematics functions as a scaffold, where, during a development and development phase,
these communications can direct learning and support (Ahlström 1996).

At school, it is the student's first encounter with the subject and surroundings that is
important. With these first impressions, students receive an experience that affects their
feelings and perceptions which give rise to impulses in them. They get thoughts, feelings, and
ideas. These students need to be able to express themselves, and through this work, the
student reflects and new discoveries and emotions will take shape. Students need tools to be
able to express their ideas and impulses in order to develop emotionally into reflective
individuals (Karlsson 1998).
At the beginning of Lgr11 it is written that during the school's core values and mission, drama, dance, music and creativity in art and design shall be integrated throughout the business so that they will be given opportunities to experience different forms of knowledge. Through the aesthetic elements, students have to develop different forms of expression by trying, and through this the students experience different moods and emotions. This contributes to a harmonious development of the students, and they will have opportunities to explore and acquire new skills, created through their own abilities (Skolverket 2011).

Art challenges us to see our knowledge of the uncertain, contradictory, incomplete and ambiguous. It creates with the help of aesthetic images of reality. Art leaves room for emotions and moods. The experiments are with you and allow us to each search for different answers, in a concrete and sensuous way. Art asks, and it gives no definite answer. Teachers do not make sense by just saying that, it's about how they say it. Art is questioning and critical and provides diversity and concreteness. It is present with all its opportunities and expectations. This means that all areas of knowledge in school are something they should embrace. The arts, the aesthetic are part of all knowledge. Art leaves room for discussion, and it helps us to develop mainstream thoughts and feelings (Aulin-Gråhamn, Persson & Thavenius 2004). Students are challenged when they have to look beyond the question of right or wrong, and work around the subject. By questioning why and how, and by using their creativity and curiosity through aesthetic opportunities for dialogue and concrete problems by hand when they are experimenting, students gain knowledge. The education must include different forms of expression and perspective to inspire students to do just that, to learning to relax, and make them richer in knowledge (Aulin-Gråhamn, Persson & Thavenius 2004).

The image of teaching as a knowledge tool can be seen as a help for the student to analyze the surroundings, and to become an indulgent, tolerant and thinking person. The substance also stimulates students' natural creative needs, teaches them to be critical and to contribute to a harmonious development (Aulin-Gråhamn, Persson & Thavenius 2004). Music is a subject in schools that contributes to students' participation in a more social context where there is space to both listen to, and understands each other. The substance also helps with a variety of forms of knowledge for the student, including motor, emotional, existential and aesthetic. The student learns to feel, express, communicate and develop their identity (Aulin-Gråhamn, Persson & Thavenius 2004). Drama as a subject has its own curriculum at the school, but is used as a method in other subjects. Even this topic emphasizes the social and personal development of the student. By experiencing drama, the student's fascination and overall experience provide opportunities for self-formation (Aulin-Gråhamn, Persson & Thavenius 2004).

Photos are very important for the way people think, learn and experience themselves and the world. We are constantly surrounded by images that are intended to inform, persuade, entertain and give us aesthetic and emotional experiences. Knowledge of images and image are important to be able to express their views and to participate actively in society. By working with different types of images, people can develop their creativity and imaging capability (Skolverket 2011).

Aulin-Gråhamn, Persson and Thavenius (2004) write about that they think it is time for schools to formulate a new mission, where the aesthetics involved in all teaching is to foster the creation of meaning in all subjects. They believe that all subjects and all teaching can add an aesthetic perspective. The situation of the media in today's society has changed how the
formation of the students is today. All teachers should develop their knowledge of culture that can permeate their subjects, then curiosity, willingness to learn and be involved, and imagination will be promoted by all students by being an aesthetic practitioner as a teacher. It's about having the students to converse with each other. They should be active both practically and theoretically in order to obtain experiences and ideas. The aesthetic practice gives everyone a chance to participate, regardless of the starting points they have (2004).

The school is constantly evolving, and there is now a new era, an era where flexible and individualized work becomes more controversial and appealing. Aesthetic expression is part of the new learning styles discussed. Through aesthetic learning processes they convey knowledge and meaning in teaching. Therefore it is so important that subject teachers also follow developments in the school, and they acquire skills to be able to add aesthetic perspectives on teaching and its area of expertise and take advantage of students’ prior knowledge (Aulin-Gråhan, Persson&Thavenius 2004). Unfortunately, knowledge obsolescence in many schools and of many educators, are viewed as old traditions that do not comply with the development that makes the school run in the wrong direction. You have to carve out time for aesthetic learning processes and conversations. You have to understand how students enhance their self-esteem by making use of aesthetic work in education, and how it strengthens speaking and writing the language, and facilitates learning (Aulin-Gråhan, Persson&Thavenius 2004).

4.4 Subject Integration
By studying the culture of the school, one would preferably be able to see opportunities in the things that we have not seen before. Unfortunately, the practical and aesthetic subjects fall under the notion that they are more directed towards the game and the childish, and the natural sciences, are however categorized as serious and intellectual. The reason for these beliefs is likely to be the vision you have for work and leisure, as well as for art and science. In order to change education in schools, and to change these perceptions, it is necessary to discuss the concepts of aesthetics, culture and education as a means to both deepen and broaden the work in all subjects at school. It is required that one can think of the practical-aesthetic subjects as something that contributes to learning by pupils stimulating their creativity and imagination (Aulin-Gråhan, Persson&Thavenius 2004).

Löwing and Kilborn (2002) address the importance of subject integration that should take place in mathematics, and it is often done without thinking on it. They argue that subjects often need the support of another substance to absorb another in teaching, as subjects and knowledge often only exist in a compartment but it has a natural interaction with other aspects (2002). The authors have written a list of specific examples of the topics and the way subject integration could look and function;

- "Swedish notably the language and forms of expression, etc.,
- picture to interpret and depict geometric objects and to reason through images and imagery,
- crafts in terms of concrete models, drawings, scale, and accuracy;
- Social Sciences at the examination of numerical data, interpretation of charts and graphs, and to understand and use simple statistical models [...] "(Löwing&Kilborn 2002: 301).

By integrating images as an activity in mathematics education, the pupils gain a broader view on the subject and it can give the teacher an idea to get an idea of how students think and reason. You can use an image with a lot of content, where many things are happening at the same time, to start discussions and ideas that are characterized by students' different experiences and levels. They are free to think about what's going on and come up with their
own mathematical calculations and problems based on the image. This is an approach that stimulates their imagination and creativity and where they get the opportunity to work according to their own abilities, even though they have the same material. You can let students form their own images that follow to come in as many problems as possible, and then solve each other's data (Ahlström 1996). This kind of work requires students to talk mathematics with each other to be able to describe their fictional problems from the picture they used. When they tell you what and how they did it will their thinking be more visible for them. Students often hear when they pronounce a problem aloud if it's right or if it sounds weird, and they are given the possibility to decide themselves on any misconceptions and change the thinking. They develop skills for themselves to find out solutions and to evaluate if it is true (Ahlström 1996).

For education to promote learning through the practical-aesthetic, it does not mean that you have to go from theory to practice. There are many opportunities to turn it around and think from practice to theory. This can be done by presenting other school subjects in mathematics, the handicrafts are common practical tasks that have a clear connection to mathematics. You make measurements and calculations of surfaces and distances and treating device changes, scales and space. This could be presented in a clear way for the students. They may, by means of a practical and aesthetic substance, get a sense of reality to the mathematical concepts to take from practice to theory (Ahlström 1996).

The music is an aesthetic aspect that is found in all cultures. It affects all people in one way or another, physically, emotionally, and in our thoughts. It always means something for all people, in many different ways. Therefore, it can be used in many different contexts as an aesthetic expression, to promote students' social community and to influence identity development with text, image and dance (Skolverket 2011).

One can usefully take the help of sport when students will develop their skills in problem solving. In the subject, one can find many problems that students can solve, for example, in the game tables or talk about different fields’ size and design (Ahlström 1996). All subjects have a historical part that must be included, and you can easily work on the history of mathematics, by also integrating geography, history and religion of the subject. It is through activities that stimulate creativity and imagination along with the facts. Work with the students to move the classroom to Egypt, or let them be Babylonians. This image can also be integrated into teaching, for example by making papyrus or clay tablets that students should write on. The picture is thus one of the forms of expression as an aesthetic learning process students will use, in order to gain a deeper understanding and a greater empathy for historical mathematics teaching. It is also in this kind of learning how to treat, for example, what the Babylonian number system looked like, and to compare with how we write the numbers today (Ahlström 1996).

When dealing with the history of mathematics in the classroom, it is advantageous to use a variety of practical and artistic activities. The Babylonians wrote on clay tablets with a so-called cuneiform. One can orchestrate this with students in a creative and imaginative way while dealing with various number systems and data. By making use of clay, empty glass bottles, ropes, papers and pencils to carve with, you have created a student activity where they will carve numerical data on the rolled out clay with a clear content, and then solve (Ahlström 1996). This is a method that is both practical and aesthetic, with a theoretical basis. Similarly, students can work with to make their own papyrus scrolls when you then come to the Egyptian number system using rough paper, paper clips and pen (Ahlström 1996).
4.5 Manipulative mathematics

Manipulative mathematics is a way of working with the abstract mathematics to make it more concrete by involve the mathematic concepts. It is about using materials that is both visual and tactical appealing, where they can be manipulated by experiments the students do. It can be ordinary materials such as things from the nature, but also educational materials that are manufactured especially for mathematic lessons. It is also considered that it is important for the learning to involve elaborative materials to the mathematic lesson, no matter what age the students are (Rystedt & Trygg 2010). If the work with mathematics is made in an exploring way the students gain experiences of their own, which opens up for discussions and investigations that give them insights to understand how things works. The student will also get the opportunity to work at a level that is right for them and develop knowledge at their own terms. Although it is important that the educator is well educated and engaged to make the work with manipulative mathematics meaningful (Rystedt & Trygg 2010).

Ahlström (1996) write that in mathematics education, students should be given opportunities to work on the practical and aesthetic subjects and artistic creation to more easily manage the concrete material and to understand deeper concepts. In order to promote students' conceptualization, it is about varying the practice and theory of teaching. Dewey came with his thesis "learning by doing", and believes that it is important for students' knowledge that they will find different methods to try and deal with concrete materials. If one applies the teaching laboratory material that allows the student to discover, then what they are learning with them is more permanent, as opposed to only when the teacher explains the concept- a method which can shorten the learning process of the students (1996). By working with their bodies and using elaborative material the students get help to a further thinking, to solve problems and to understand the abstract nature of mathematics (Rystedt & Trygg 2010).

Games as a manipulative material became common during the 90’s, but the perceptions about its use are torn among the didactics of mathematics. Some say that the students can get a negative view of the subject and some indicates that it can give much to the education because of the fact that the students has to communicate with terms that is used in the mathematic language and that the subject can be seen as fun. But it is important that the games are used in a thoughtful way (Rystedt & Trygg 2010).

It is easy to show students that mathematics is involved during almost everything you do by making use of ordinary materials and practical work. “Cooking, gardening and joinery are a few examples that give both a practical and theoretical knowledge” (Rystedt & Trygg 2010: 10). Materials gathered from the nature such as seashells, acorn and chestnuts can easily be used when students practice reckoning. The goal by using elaborative materials is to help the students understand the abstract concepts and symbols in the mathematic language (Rystedt & Trygg 2010). Mathematics is hard to understand for some students because they can’t see the connections between the physical and the abstract world. This connection makes it easier for them to grasp when they get the opportunities to work elaborative. With this said it is equally important as an educator to guide them away from the elaborative materials into work with the abstract language and symbols that mathematics is about. Otherwise there can become a risk of that the students always will need the materials to be able to think about and solve mathematic problems instead of getting a deeper understanding and knowledge as the material is supposed to give (Rystedt & Trygg 2010).
5. Method
In this section I will describe the methods I used and how I did to complete my investigation. I will bring up the ethical principles and what to think about when you gather information to this kind of study.

5.1 Selection
The school had divided the student in two groups; infants at ages 3-6 and juniors at ages 7-11. I chose to focus on the juniors lessons since they were in the same age as my students will be when I am a teacher. Therefore I was observing in junior 1-4 and I also interviewed the four teachers that had this classes. I visited every class about two times each and participated during the math lessons. When I was in the classroom I helped those who needed help with the tasks and took the opportunity to ask them a few questions about how their thoughts were towards math at the same time. I did eight observations altogether.

The four teachers that I interviewed were all middle-aged women and had university education from their own countries, but with different nationalities. They were from Barbados, Canada, England and Scotland. I chose to interview these four because I had been observing in their classes and felt that the interview would give me more if I talked to them about the lessons that I had seen, as I explain in 5.2 Choice of methods. Because of the anonymity I don’t use their real names and have therefore decided to refer to them by the name of which class they had. In other words: the teacher for the 4th grade junior class is going to be called “TJ4” and the whole class will be referred as “J4” and so on.

5.2 Choice of methods
When the interviews and observations are of a qualitative type is the study qualitative. The methods can be described as when the area of the interview questions is decided in advance but the questions itself can vary. The same with the observations, you know what to look for, but the structure of the observations can vary (Johansson & Svedner 2010). I choose to use both interviews and observations to gather information about the teachers’ approaches and attitudes against practical and aesthetic tools during the mathematic lessons. The study is about how they teach mathematics with focus on the practical and aesthetic subject integration during the lessons and I observed the math lessons in the junior-classes. I decided to make the observations before I did the interviews, because I felt that the interviews would give me more if I already had an idea of how the lessons looked like. The interviews would be more relevant and giving if I in advance had explored the school and met the teachers and students. I could make the questions after what I had seen and not seen and we would be able to discuss why it is in the way that I have seen. I would be able to get a better understanding to their answers because I have seen, experienced and participated during the mathematic lessons.

To get an understanding of if the lessons vary between the different ages I observed the math lessons in every junior-class, the age’s seven to eleven and there were four of them. Observations are a good method, since you easy both can see and describe everything that is happening. I did a planned observation, which means that I from the beginning already knew what I was going to observe (Kylén 2004). I wanted to see how the lessons with mathematics were done and if there were any practical or aesthetic subjects in cooperated to the education. I did these observations because you do not get all the information just from using interviews, you have to see and feel what is happening yourself and then talk to the, in my case, teachers about what I have seen and felt. The observations I did can also be described as unstructured, as I wrote down what I felt was relevant and important for me to remember. I did not count
the students or how many times they needed help. I took notes of the lessons’ disposition and
content. I observed what happened during the lesson, the students’ attitudes and what they
did. A more structured observation would be more detailed and involve the number of
students, their sex and a mark every time someone asked for help or did something else. I did
not find that information relevant to what I was studying so therefore my observations are
unstructured. With this method I have room to notice unexpected events and happenings
during the lesson, something I find more interesting and important (Kylén 2004). I used
something that Kylén (2004) refers to as “free observations”, where the actions that I see and
find relevant is being documented with my own words and without any pre-designed
categories (2004).

Johansson and Svedner (2010) writes about a method of observation called “critical incidents”
where your observation is based on the questions that I want to have answered. It means that
you are taking notes after the important events that are happening based on what you are
looking for your study. This method is good to use when you know what you are looking for
and you can easily observe the actions in the whole classroom at the same time as you taking
notes. With this kind of observation you do not use any categories, the notes are holistic for
what is happening during the lesson. You are not observing every student individually, but the
whole class as a unit and the situations that appear is in focus for documentation (2010). By
using this method I had the time to describe what actually happened during the lesson and was
not bound by any categories. My focus was to see if whether practical and/or aesthetic
methods was used as aids during the mathematic lessons, which made my notes extensive and
qualitatively with clear descriptions of what has happened (Johansson & Svedner 2012).

When the observations were done I started to interview the teachers of those classes that I had
been observing, to get a deeper understanding and a better perspective to what I had seen.

An interview can be short and long, open or guided. It can also be performed in a group or
with one individual. My interviews were short and they all are between 8-16 minutes, but this
was enough to get the information that I looked for to my study. I also chose to interview one
teacher at the time. The short interviews are often more structured than the longer ones and
have questions that are made in advance to be answered during the conversation. The
interviews were not very guided, only with a few questions that I wanted to have answered. In
this way the teacher that was being interviewed could speak freely about the subject and I just
guided if I felt that I need more information. This is called an open or unstructured interview
even if it is short. With a structured interview with structured questions your goal is to have
exact answers. I was looking for an interview that was short, but unstructured and open to be
able to talk relaxed and have a discussion about the questions with room for more and other
questions (Kylén 2004). When the open interview is used as a method you can have a paper
with the questions as help to present the questions to the person that you are interviewing.
You also describe the disposition of the interview and what you want to know. This paper
should contain about four to six open questions with room for subheads. If the questions are
too detailed the interview will be guided and not as open as you would like (Kylén 2004).

The interview questions were the same as I use in 2 Purpose and Issues;

- In which way do you work with mathematics during the lessons, and why?
- Which materials are being used?
- Do you integrate any practical and/or aesthetic subjects to the mathematic
  lesson? Why, why not?
Do you think that it would enhance the students learning, understanding and desire to learn by using aesthetic subjects and more practical based lessons?

Kylén (2004) is presenting a model of interviewing called “the funnel-model”, in which he divides the implementation of the interview in six steps; opening, free narration, definition, control, information and conclusion.

**Step one- opening**
The interview starts with a presentation of the one whom making the interview and the purpose to the interview, the disposition and how long it is planned to take. The paper with the questions will be shown and you method how to document the interview will be described.

**Step two- free narration**
The interviewed person answers every question with an open and free narration. During this time is the one that is interviewing quiet and pays attention to what is being said for further subheads if necessary. When the person that is being interviewed can talk without being interrupted him or she can give more information rather if the interviewer also talks a lot. Always let the one that is getting interviewed have time to think of the answer, do not rush with more than one question at the time, if there is silence they are probably thinking.

**Step three- definition**
When the interviewed person has spoken about the question you have to make sure that you get a concrete answer, you also follow up the deeper questions and ask for examples if necessary.

**Step four- control**
At this point you are making sure of that you have understood. If you did not understand an answer, or if the person changed his or hers narration by the end of the interview you can ask them to tell you again or to be more clear in their description. Sometimes they change their answers subconsciously and did not notice the change themselves. You can also make a short summary of what the interviewed person have said in the end of a question to see if you have understood everything correct.

**Step five- information**
When you are at the end of the interview you do a summary and give the interviewed person more information about your study and give him or her opportunity to ask questions about it.

**Step six- conclusion**
You thank the person for the cooperation and take the information you need if you would have to talk to him or her again if there is something missing. There is always good to have a good conclusion if there comes up some wonderings in the future and you would need to contact that person again (2004: 31-39).

I tried to follow this model as best as I could during my interviews and I felt that a free conversation was the best way to get the best result of the interviews. By letting the interviewed people speak freely about the questions and, in this case, the work I felt that I was given the most honest answers. I feel that it is much easier to have an open conversation when the atmosphere is relaxed. It is not so much a negotiation as I feel that a more structured and guided interview can be.
It is also important to make sure of that this method of an open interview does not wander away from the subject. It is important to listen carefully and let the person have time to think and speak free. If you have decided to make a qualitative or unstructured interview it is important to stick to that plan. If you are not listening or making sure that you understand you will rather have a small talk rather than a good interview (Johansson & Svedner 2012).

5.3 Procedure
When I first came to the school the principal gave us a walk around the area and introduced us to the teachers and classes. Then I walked by myself around the area and talked to the staff and visited the classrooms again. I spoke to the teachers at the junior-classes about my thesis and asked them if I could observe their math lessons. All of the teachers welcomed me into their classrooms. When I first visited the classes I presented myself and then I sat in the back of the classroom during the presentation of the tasks of the day. Then I circulated and helped the students that needed help. I had paper and pen with me and took notes at the same time as I was more like an assistant to the teacher than a stranger who only observed the lesson. The notes were in detail and about the actions in the classroom, without values of personal thoughts (Johansson & Svedner 2010). I talked to the students at the same time as I was helping them, to get an understanding of their thoughts about mathematics without interviewing them. I made that decision for the reasons that I did not need the parents’ approval if I did it this way, and the student would not feel the same pressure as if we sat and had an interview. This way I felt that the answers from the students would be more relaxed and therefore more honest.

During the observations I also talked to the teachers about the upcoming interviews, and asked them if they would like to be interviewed. They all said yes, and that the only problem was to find the time. At the end of term there is much to do as tests, plays and a Christmas carol performance. I kept my calendar empty so that they could say a time whenever they could find one. I asked all of them if they would be comfortable if I recorded the interview, and I assured them that they would be anonymous and no one but me would listen to the recordings. I also told them that the recordings would be destroyed as soon as I had documented them and finished the project. With these words all of the teachers felt relaxed and approved the recordings. People can feel inhibited to say exactly what they want when they get recorded (Kylén 2004) and that is why I made sure of that they knew this. All but one of the teachers wanted to sit in their classrooms and before every interview I talked shortly about my thesis and why I had these questions. I did that because I wanted them to be prepared for what to come, and also to feel that it is nothing to be nervous about (Kylén 2004). My thought for the interviews were that they should be relaxed and more like a nice conversation between two persons that is interested in teaching, rather than a stiff interview where the teacher felt that she must give me the right answers instead of her own.

The interview with the teacher in the junior-4 class was taken place in the staffroom during lunch break, because that was the only time she had for me. The other interviews were done in the teachers’ classrooms after the school has ended. All of the teachers did the best they could to find time for an interview. This was done at the end of term and they all had a lot to do. Therefore I had my calendar open so that they could choose the date and time whenever it was the best option for them. Before the interviews I talked to each teacher about my study and which questions that will come up. I also made sure that all of the teachers were comfortable with my decision to record the interview rather than taking notes.
I also chose to interview one teacher at the time, to be able to focus on what that one person was saying and to give her the space and time to talk about the questions and think of the answers. I felt that it would give me more if I could give the teacher all of my attention.

5.4 Validity and reliability
The terms validity and reliability are often used to describe the quality of a study. Validity stands for the value of the work, how valuable the information is for the work that we are doing. And if the information is relevant to what you want it for, and that it is correct and usable. To make sure that the validity is good when you are gathering your empiric material it is important to ask the right questions. It is not relevant for the study if my questions are interesting for me, but does not give anything if it is not important for the study. You have to make sure that you understand the answers, and that the person that is answering understand the questions. The person that is answering also has to know the purpose of the investigation that you are doing (Kylén 2004).

The reliability in a study describes how much we can trust the content. When you talk about the reliability you are talking about if the facts or information in a text is showing the truth. To get a high reliability in a study you can do the same gathering of information more than once to make sure that the results is the same every time. That people has not change opinion and therefore gives different answers. By doing this you control the information to make sure of that it is still the same and has not changed. It is about testing the stability of the gathered empiric material. An interview can be different each time, but as long as the answers and opinions is the same the material is stable. By being clear of why you are making the interview, using that questions or doing the observation you minimalize the risks for misunderstandings. To avoid that the person you are interviewing decode the questions it is important that the questions are easy for the person to answer, with no room for misunderstandings (Kylén 2004).

5.5 Ethical principles
You have to show respect to the people that is a part of your study. They have to get the right information, and all information that you can give about the study. They have to know what you are investigating and why you are investigating it, the purpose of the study must be clear. It is also important that the persons know that they a free to choose if they want to participate in the interview/observation or not. If they would feel that they do not want to be a part of the investigation anymore, there is no problem for them to choose to not be in it at any time. This must the investigator inform all of the involved persons about. No one will ever be forced to participate, and anyone can leave the interview/observation at any time. It is also important to make sure of that every person that participates knows that they are and will always be anonymous. It is about respect for those who are willing to help with the study, and it is about to make them feel comfortable during the time they assist you with the information and help that you need (Johansson &Svedner 2010).

To make sure of that the teachers knew this I told them what I wrote about and what I was going to study during my observations. I also gave them the interview questions in advance and explained to them that they would be anonymous and made sure of that it was okay for them to be recorded. I informed them that they always could choose to no longer participate as well.
5.6 Data processing

My data consisted of interviews and observations. I recorded the interviews on my mobile, transferred the files to my computer and transcribed them immediately when I came home after every interview. I wanted to make the transcription as fast as I could because I felt that it would be easier when the interview still was fresh in my head.

The observations are described in detail at both 5.2 and 5.3. I circulated in the classroom and helped the teacher and the students at the same time as I observed. I took notes once in a while and used only paper and pen. I spoke to the students at the same time as I helped them. After every observed lesson I went through my notes and added things that I had missed to write down. I marked every observation with time, date and the name of the class.

I later broke down all of the observations and sorted the pieces after the questions that I present in 2 Purpose and Issues, and did the same with the transcribed interviews to be able to see the results more easily.
6. Result
In this chapter I will present the information that I have gathered through the various observations and interviews I did during my investigation in Barbados. The results are presented in sections regarding the issues that I mention at Purpose and issues.

6.1 How the teachers worked with mathematics during the lessons
At the 1st junior class (J1) there were a lot of hands-on-activities during the mathematic lesson. For one example from observation: when they worked with geometry the students had as an assignment to draw an individual robot by using the geometric shapes that they had talked about previous lessons. They had before this lesson looked for materials existing in the classroom, such as Pringles tubes and dices, to see the shapes and then TJ1 taught them how to draw the different shapes. They also played a lot of classic board games during the mathematic lessons, such as Domino and Ludo so they could practice basic counting 1, 2, 3… and learn to see patterns. TJ1 described the lessons by following; “They have book work, obviously, but usually we have something practical to do. So that we do something with the hands [...] and then we do the written work into the book”. They were mixing the theoretical and practical aspects during each lesson at the beginning of the term, but as the year progresses they were using less practical work since the students were expected to be able to the given work on a piece of paper. “The J1 is really the transition from practical work to working on paper, to written work”.

TJ2 said; “I really try to use a lot of hands on ideas to get them excited about wanting to learn and wanting to know a bit more about maths. But as well.. it is a little more practical because basically if they don’t know what 250 grams looks like it is kind of hard to do it when it’s written work”. The practical aspect had a big part of their way of work with mathematics at J2. During an observation TJ2 gave the students word problems and the children had to hold up which sign they thought it was. They had been measuring items in the classroom, outside and weighted the items in their lunch boxes to get an idea of the concepts. TJ2 tried to incorporate at least one activity for each subject area dealing with art as well as she used the computer lab for math themes. The J2’s worked a lot with hand on activities, computer games and math games because TJ2 want to “find some fun things for them to do” so they also think it is fun to do it and learn more. To prevent that the students would think of mathematics as something boring and abstract TJ2 was constantly working with practical mathematics in as many different ways as she could.

At J3 they basically only worked with formulas because, as TJ3 said; “it is the only way to do it”. All of the work with mathematics was theoretic and written work. TJ3 described the lessons as “chalk and talk”, which means that she wrote on the blackboard and talked while the students answered her questions and wrote in their books. During my observations there were nothing to do than sit on my chair in the back of the classroom and listen as the whole class. TJ3 explained that it was a lack of materials and time that was one of the reasons of why they worked in this way. She mentioned the computer lab, but admitted that she barely ever use it. J3’s did not do any practical work at all, but TJ3 was positive to the idea, and would like to work more in that direction if there would be more time and materials for it. On my question if they ever work with anything other than chalk and talk in J3, she simply answered “I don’t know what the other schools do or if they have more money, but we don’t have it here”.

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TJ4 explained that at this stage the students would “[…] have gone through the practical aspects of it already”, and that she was making them ready for the exam next year. So it was a lot re-vision and she did a lot of chalk work, like writing on the blackboard. She tried to use some different methods as much as she could, like clocks to tell the time, but said that they have not got enough equipment and time to work more different than that. It is mostly just chalk and talk, because the students should have the basics already. “It is really more pencil and paper” she said. When I observed the lessons I saw no difference to what TJ4 later said during the interview.

6.2 Materials that were used

J1 and J2 used very similar materials during their mathematic lessons. Besides the obvious pencil and paper they used rulers for measuring and scales to weight different objects. When they did this “hands on activities” as they called the practical work, they used whatever object that could be found in the classroom. TJ2 explained that they did a lot of experiments by looking at the content of the student’s lunch boxes. They measured the boxes and items and discovered how much the items weighted compared to each other. They also brought fruit into the classroom and cut them up into quarters and things like that to make it more visual.

At J1 they incorporated board games to the mathematic lessons, and TJ1 thought that it was a good way for the students to practice the numbers order. By throwing a dice and first count the numbers on it, then move as many steps as the number on the dice says help the students to learn, she thought. TJ1 also used Domino as a way to teach the students to see patterns so that they eventually will see if there is a five or two without counting the dots, but just by recognize the pattern. TJ2 has designed different math games for her students to take home as homework once a week. At the J2 classroom they had also build a small kiosk for the students to shop in, they got tickets with different value depending on their result and behavior that they can use and buy something small for. So they had to think about what they have to pay and how much change they are going to get. At J2 they had also made cards with the mathematic signs on that they use when TJ2 was making word problems and they used clocks to move the pointers to different times that they were assigned to do. J2 did also much frequently use the computer lab for math games.

J3 used almost only pencil, scales and paper while TJ3 was writing on the blackboard. They rarely went to the computer lab and sometimes they were using clocks to tell the time. J4 did not use any other materials than pencil, scales and paper while TJ4 was writing on the blackboard. Because of the upcoming exam there were no time for that and they should not need to work practical because the basics should already be there, TJ4 said.

6.3 Practical and/or aesthetic subjects integrated to the mathematic lesson

TJ1 integrated, as well as the computer lessons with the mathematic lessons, also art. For example the robot that I mention in 6.1, and they measured to make borders on a paper and to get the painting or drawing in the middle. She said that it is always easy to incorporate art in every subject, and that the children love it because they have no idea that it is math they do. “Children learn in different ways, so not every child is going to learn from seeing things on paper” she said. Some children just need to see it on paper and they get it straight away, but some have to do it to actually understand, and when they have done it they will remember it the next time they see it on paper, she explained. Sometimes they integrated drama and work with role play, like shopping with money and TJ1 was the shop keeper and the children went to her for buying something from her to figure out that they have to take away or add. TJ1; “Because of the different learning styles, they have to have the information in different ways”.

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J2 worked a lot at the computer lab, and integrated art to her mathematic lessons. They were playing computer games relevant to the theme that they were going through and drawing shapes as well as making their own math games. TJ2 had also made a small kiosk (mentioned at 6.1) where they role playing that the children was shopping, so they also worked with a little bit of drama to wider the understanding for every student. They were also measuring both on paper and other objects.

TJ3 explained that she would like to integrate other subjects, but that she does not. Because of the time and the lack of equipment there was no way to do it. TJ4 answered very short and precise “No, not much of that. I would like to. But not much of that. Not in this year”, and explained that it was because of the 11+ exam, which is very big in Barbados and that she therefore are very exam-oriented. She said that she does not work with more than pencil and paper because they move forward and it is working kind of like a bridge from the practical way of work to the more theoretical.

6.4 If it would enhance the students learning, understanding and willing to learn by using aesthetic subjects and more practical based lessons

TJ1 was sure of the fact that the student’s possibilities to learn, understand and desire to learn have to do with the way of working with mathematics in a practical and aesthetic way. Like when they are doing clocks. The children had to do the clock faces by themselves by cutting it and coloring it. And they also had to cut the short hand and the long hand and decorating them, “which means more to them than just see it on a paper” TJ1 said, and they will remember which hand is what because they have done them. They remember what they have done, and they understand when they see, which makes it fun.

TJ2 was working a lot with practical and aesthetic activities and thought definitely that the students develop a better understanding and willing to learn by far. Sometimes she could see on the students how it all come together when they started working and they realized that what they did before actually learned them something at the same time as they had a fun doing it. “It is extra practice that they don’t see what they are getting” she said about the math games and explained that the students looking forward to the homework every Tuesday because it is fun. In this way they are willing, they see that it can be fun and they will understand because they work in so many different ways.

TJ3 was very positive to the effects of using practical and aesthetic activities during the mathematic lessons. She said that all students learn in different ways and that some understands abstract concept really quickly while some need to see what it is to understand what they are doing. There were no doubts that the students would see it as more fun and therefore interesting.

“I think in the long run, yes” was TJ4s answering to my question, and she was sure of that there would be positive for the students to work in a less theoretical way. They learn by doing, and they would understand more easily. But there were no time for it and there are no materials. TJ4 felt very rushed in her year and did not have the time to work in this way, even if she believed that this type of educating mathematics would be good. She also said that in the same time there were so many other subjects that the students have in school, so it was better to just stick to one and get that one organized.
6.5 Other answers that came forward during the interviews
Barbados is very driven for the 11+ examine and the teachers in the ages 9-11 find it hard to get time to work more practical with the children by involving aesthetic methods during math. But they also thinks that it is a very important part of the children’s education to have the opportunity to get a wider learning and have therefore “practical math” once a week. This is a class that the ordinary teachers can’t take away and has to be fitted in on the time table in each class. A solution the school find necessary because of the pressure that both the teachers feel to prepare the students for the exam and for the students to have an opportunity to get a better understanding.
7. Analysis
At this section I will analyze the results of my investigation with the theories that I am presenting at the beginning.

7.1 How the teachers worked with mathematics during the lessons
Both J1 and J2 were working a lot with manipulative mathematics, which is described by Rystedt and Trygg (2010) as a way of working with the abstract mathematics to make it more concrete. It is about making use of visual and tactical appealing materials that can be manipulated by experiments done by the students (2010). An example on that is when J1 was working with geometry TJ1 taught the students how to draw the shapes by doing a robot and then let the pupils draw one of their own when they had searched through the classroom after shapes and talked about them. Ahlström (1996) is writing about that students should be given the opportunity to work with artistic creation to more easily understand deeper concepts. It is also important for the students’ knowledge to vary practice and theory during the lessons and let them try different methods and to deal with concrete materials (1996). TJ2 explained that the reason to why she was working as much as she could with hands on activities were that if a student does not know what 250 grams look like it is hard for them to understand that in just written work. Which is what Ahlström (1996) is describing above and as well when he writes that if the teacher applies laboratory material to the lessons that allows the student to discover the concrete material and get a more permanent learning (1996).

Rystedt and Trygg (2010) says that it helps students further thinking and understanding of the abstract nature of mathematics if they get to work with elaborative materials (2010), and the practical work was a big part of the work during mathematics at J2. TJ2 put a lot of effort to incorporate at least one activity for each subject area in as many different ways as she could to prevent that the students think of mathematics as too abstract and therefore boring. How students encounter with mathematics during their first years in school is important, as it possibly can affect their attitudes against mathematics in the future (Ahlberg & Wallby et al 2000). TJ2 was all about that the students should have fun with the subject in order to truly understand it and create a desire to learn more. TJ1 varied the lessons as well to make it fun and interesting to create, as Ahlberg and Wallbymfl (2000) writes a learning environment improves curiosity which will lead to creating knowledge. It is also about not exposing too large, formal requirements too early for the students. If so then there is a risk that the consequences will be a negative view of the subject and that the students does not understand the meaning (2000).

Both TJ3 and TJ4 didn’t do any practical work, and both said that it was because of the time restraints. It is about planning the lessons to promote student learning in the best way and consider that stress affects students’ concentration and memory. Therefore is it important to vary the theoretical subjects with practical work which can function as a de-stressing relaxation (Dahlin, Ingelman&Dahlin 2002). J3 did not during any circumstances work in any other way than what TJ3 described as “chalk and talk” which is when TJ3 is writing on the blackboard and the students write it down in their textbooks and answer the teacher’s questions. TJ4 didn’t either do anything else than chalk and talk with the explanation that the practical aspects should be covered at this stage and that she had to make the students ready for the big 11+ exam next year. It was a matter of time that TJ4 felt that she did not have to make the teaching different. At J4 it was really just pencil and paper. Ahlberg and Wallby (2000) write that to promote learning, students need to have space to argue and discuss the solutions they do in mathematics. This will help the students to develop and create faith in their own abilities, their own thinking and their mathematic skills (2000).
J1 and J2 were obviously working a lot more practical than J3 and J4. TJ1 described her lessons that the students did something with their hands and then did the written work into the book. TJ3 said that her year were like a bridge to J4, preparing them for the exam. And TJ4 said that the students should have gone through the practical work already and that the basics should be there. Rystedt and Trygg (2010) write about practical work with mathematics as something very important. But they also highlight the importance to guide the students away from elaborative materials and practical work into work with the abstract language and symbols that mathematics is about. If there is no transition from the practical to the more strictly theoretical work can there be a risk that the students will need the materials to be able to think about and solve mathematic problems instead of getting a deeper understanding and knowledge as it was meant to (2010).

7. 2 Materials that were used
Besides the obvious pencil and paper they also used scales and rulers for weight and measuring of different objects and used whatever they could find in their classrooms and outside at J1 and J2. TJ2 explained that they did a lot of experiments by looking at the content of the student’s lunch boxes and measured them and compared the items with each other. Sometimes TJ2 brought fruit into the classroom and cut them up into quarters to make it more visual. By making use of ordinary materials it was easy for the teachers to show the students that mathematics is involved at almost everything you do (Rystedt&Trygg 2010). At J3 there were no materials but pencil and paper used at all, this because of the lack of materials and money to get some TJ3 said. TJ4 was only using pencil and paper because there is no time for anything else and the basics should be there already. When students is practicing reckoning can materials gathered from the nature such has seashells, chestnuts and acorn easily be used (Rystedt&Trygg 2010). For some students it can be hard to see the connection between the physical and the abstract world, by working elaborative can it make the connection easier to grasp by getting the help to understand the abstract concepts and symbols. There are both the ordinary things from the nature for example and educational materials that are manufactured especially for mathematic lessons to choose from, however is it important for the learning that the lessons involve elaborative materials no matter what age the students are (Rystedt&Trygg 2010).

Ahlström (1996) lifts the fact that how the students feel about mathematics is crucial in deciding how the learning is affected. By working with different methods and materials the teacher can arouse the students desire to learn and develop their views in the subject. The teaching should be varied and contain interesting approaches that is relevant to the topic and should not be guided by the textbook. By allowing the students to see connections and patterns in different kinds they will develop a more positive view of mathematics and get confidence in their own learning (1996). TJ1 incorporated board games to her mathematic lessons and thought that it was a good way for the students to practice the numbers order. She explained that it helped the students learning by throwing the dice, count the numbers and then move as many steps as the number says. TJ1 also used Domino as a way to teach the students patterns so that they eventually could recognize and see if it is a five or a two without the need to count the dots. TJ2 had the same attitude towards games as a good way to work with mathematics in a fun way with her students. She had designed math games for the students to take home as homework. Rystedt and Trygg (2010) writes that games as a manipulative material can give much to the education because the students has to communicate with terms that is used in the mathematic language in a way that the students see as fun. Although it is important that the games are used in a thoughtful way (2010).
7. 3 Practical and/or aesthetic subjects integrated to the mathematic lesson

Curiosity, experience and knowledge should be a part of the teaching for the students to see and understand the value of mathematics, and the teacher has to put stencils and books aside to be able to involve that (Ahlström 1996). TJ1 said that children learn in different ways, and explains that not every child is going to learn from seeing things on a paper. What you do will be remembered, and it is by communicating and expressing themselves in different ways they will learn more because the subject will be concretized. Knowledge is something you build up (Aulin-Gråhamn, Persson&Thavenius 2004). The teachers that I observed worked with role play and art to make it more understandable for the students that has to see it in another way than on a paper. They used different methods because of the student’s different learning styles. J2 worked a lot with role play and art as well to widen the learning and understanding for each student, they also made math games to show her students that it can be both fun and a learning activity at the same time. Aulin-Gråhamn and Thavenius (2004) writes that by integrate practical and aesthetic activities to a theoretical subject will it be more enjoyable, students will learn much more through different learning methods because learning and creativity stands very close to each other (2004). By using art students work around the subject, and looks beyond the question right or wrong. Instead they are experimenting and concrete problems with questions as why and how by using their creativity and curiosity and therefore gain knowledge (Aulin-Gråhamn &Thavenius 2004).

Ahlström (1996) says that to help the students to develop a mathematical thinking it is required by the teacher to include creative activities during the lessons (1996).

To promote learning through practical and aesthetic methods does not have to mean that you have to go from theory to practice; there are many opportunities to turn it around by presenting other school subjects in mathematics. The handicrafts have a clear connection to mathematics and can easily be used in the classroom by doing measurements and calculations of surfaces and scales. This also gives the students a sense of the reality to mathematical concepts to take from practice to theory (Ahlström 1996) and is one of the different ways of working with mathematics at J2 where they experimented a lot in this way.

TJ3 and TJ4 were not using any practical activities, and were only referring to their lessons as “chalk and talk”. Something that Ahlström (1996) describes as that quiet and individual work that dominates in most of the schools today and that it is often one of the reasons why students finds mathematics too simple or too hard because they don’t get either not enough help or not enough stimulation. The teaching should not be guided by the textbook, it has to be interesting and there has to be variety in order to treat the different needs (1996). Still, TJ3 explained that they did not work in any other way because of the lack of time and equipment, but that she would like to. TJ4 thought of her year that they are moving forward, as a bridge from the practical work to the theoretical. And that it was why they only work in the textbook. Ahlstöm (1996) says that to help the students to develop a mathematical thinking it is required by the teacher to include creative activities during the lessons (1996).

7. 4 If it would enhance the students learning, understanding and willing to learn by using aesthetic subjects and more practical based lessons

Ahlström (1996) says that when the teacher shows that mathematics can be fun, interesting and inventive will the chances be bigger that the students feel a desire to learn. By being interested of the different learning styles and methods will the students get a well-rounded education and most likely understand the purpose of the subject better as well as they will grow a positive approach to mathematics themselves (1996). During my observations I saw a clear difference between the children’s behavior during math comparing to J1, 2, 3 and 4. At J1 and J2 the teachers were engaged in the students’ education, they used a lot of different methods and put a lot of time and planning to make the lessons as interesting and meaningful.
as possible. They did not feel any pressure because of the 11+ exam and focused on the students evolving. The students thought it was fun and were interested and focused during the whole lesson. Ahlström (1996) is mentioning that the teacher’s personal attitude against mathematics affects the student’s view of the subject more than many would think. It is the teacher who reflects the most of the willpower to learn to the students. The students approach to the subject is often a reflection from their teacher (1996).

Every one of the teachers that I interviewed said that it was no doubt that it would affect the students learning in a good way, but only two of them worked in that direction. The explanation for why they did not work with other methods than “chalk and talk” at J3 and J4 was the 11+ exam. They were stressed and had not enough time to plan the lessons differently because of the test. Dahlin, Ingelman and Dahlin (2002) is talking about “play for learning” as an important method to be used in school, mainly for the de-stressing relaxation it gives to promote the students concentration, memory and therefore also learning. The play has to be designed so that the students have to use both their minds and their bodies, this can also work to take the pressure of when a subject feels difficult (2002). TJ1 was determined that the students possibilities to learn has to do with how and if the teacher work with mathematics in a practical and/or an aesthetical way. At J2 they had games to take home for homework in mathematics every Tuesday, just because of the fact that the students will understand and find it more interesting if they work in many different ways. Karlsson (1998) says that it is through the overall situation the students learn and apply knowledge, that learning takes place in many different levels and it is by interacting with each other in social settings the students learn (1998).

TJ2 was talking about how some children did not understand, and are therefore not learning, because it was too abstract. Ahlström writes that it is only one way to handle that, and it is by allowing the students to see connections and patterns that they build up a confidence to their own learning (1996).
8. Discussion
In this chapter I am going to take the analysis a step further by discussing the results of my issues to the theories with own thoughts and reflections.

8.1 Method discussion
When I first arrived to the school I spoke with the teachers and described my visit and the purpose of my thesis. I told them what I was going to investigate and that I would like to interview one teacher at every junior-class as well as observe the lessons that these teachers had. I also decided to do the observations first to complement the upcoming interviews. It was positive to do the research in this order because it gave me thoughts to discuss with the teachers and therefore gained the interviews. I am pleased with my decision of observe and interview each grade because it gave me a good insight of how the teaching varied considering the older the students got. By having the limited number of four informants and classes gave me the opportunity to spend more time with them and was a positive choice of method.

I chose to do qualitative interviews, which is when the questions is more freely formulated and can be varied in different ways. The areas of the questions are solid, but the questions themselves can be varied depending on who you are interviewing, how the informants answer and which aspects that comes up. The questions must therefore be formed so that the informant gets to say everything that he or she can say about the subject (Johansson & Svedner 2010). It was a good choice to use this kind of interview because in this way I had my area covered at the same time as I could take the informants different teaching styles under consideration. The questions would give me the answers regarding to what I wanted to investigate and no matter which one of the teachers that was being interviewed they could always answer, describe and discuss their thoughts and aspects.

To be able to keep the interviews as free and open as possible I also chose to record them, with the approval from the informants of course. Johansson & Svedner (2010) is mentioning that one of the risks with qualitative interviews is that if you are not listening closely it is easy to misunderstand and therefore have problems to follow what the informant is saying (2010). And because of that English is not my native language I had to concentrate harder to listen and felt that I probably would be distracted if I had to write the interview down during it instead of recording and focus on what is being said.

Although I am satisfied with my choice of interview method I have had to struggle with the questions when it was time to categorize them at Result and Analysis. I did not think of this during the interviews and transcribing because the discussions during the interviews was as I had hoped, but later on I noticed that the questions were so similar to each other and made the answers almost impossible to divide into different headers. For example; the use of games during the mathematic lesson is suitable both in ‘which way do the teachers work’ and ‘which materials are being used’.

I did not use any particular model for the observations. I knew what I was looking for and took notes during the lessons about what they did during the mathematics. I walked around and helped students that needed it and asked some of them what their thoughts were about mathematics. The reason to why I did this and not interviewed any students as I did with the teachers was because they were underage, I would have to contact their parents to get an approval to interview their children and I would also have to be prepared if some of this parents would like to sit by their child during the interview. I also had in mind that children can be nervous during interviews especially when being recorded and with a foreign stranger,
and maybe give me answers that they think I want to hear (or in this case that maybe their parent would like to hear) rather to what he or she really thinks. So I took the opportunity to ask the students some questions during my observations instead and hoped to get more honest answers that way.

8.2 Result discussion
The questions of my study were:
- In which way do the teachers work with mathematics during the lessons, and why?
- Which materials are being used?
- Do the teachers integrate any practical and/or aesthetic subjects to the mathematical lesson? Why, why not?
- Do the teachers think that it would enhance the students learning, understanding and desire to learn by using aesthetic subjects and more practical based lessons?

8.2.1 Discussion: How the teachers worked with mathematics during the lessons
I can see from my results that it was a clear line between how the teachers worked at J1 and J2 comparing to J3 and J4. From both observations and interviews it was obvious that the practical work with mathematics had a major influence at the lower grades, where both TJ1 and TJ2 said that it is about making the children understand the abstract language of mathematics. According to Ahlström (1996) the teachers should give the students the opportunities to work in a way where practice and theory is varied during the lessons to get a deeper understanding of the concepts and that it is important for their knowledge to be able to try different methods and deal with concrete materials (1996) and that is exactly what TJ1 and TJ2 did. It was a good way to help the students to see the connection between reality and the abstract language of mathematics, as TJ2 said; if a student does not know what 250 grams look like it is hard for them to understand that in just written work. Ahlberg and Wallby m. fl (2000) says that it is how students encounter with mathematics during the first years in school that is important for how their attitudes against mathematics affect (2000), in this early years it was all about how TJ1 and TJ2 introduced mathematics to the students. They worked in this way now because the subject was new and abstract and the students did not see the connections yet. The fact that both teachers were focused on a fun learning could give the students a positive view to the subject and a deeper understanding so that it is not that hard for them when they comes to J3 and J4.

Teaching in a practical way did not exist at all at J3 and J4, with the explanations that they do not work in that way during those years because it should already be covered and the students should have the basics and therefore no need for extra practical work. They should manage the theoretical teaching that comes in the higher years. Rystedt and Trygg (2010) writes about the importance of practical work with mathematics but they also highlights that it is equally important that the teacher guides the students away from the elaborative materials and the practical work into the abstract language and symbols that mathematics is all about. If this transition is not made there can be a risk that the students need the materials all the time instead of getting the deeper understanding as it was meant to (2010). Mathematics gets harder and more abstract the older the students get, at the earlier years they have very little or no knowledge at all and this must be introduced to them at the clearest way possible. They must first have a foundation to be able to start building, and for every level it gets a bit harder and a bit more abstract. At J4 they should have the basics and be able to think and communicate without materials as help, but in order to still keep the subject fun and interesting for the students there should still be some kind of experiments and practical work sometimes. There does not always have to be all or nothing. When the students go from J1
and J2 they probably have a positive attitude to the subject, and then they meet a whole other
teaching method at J3 and J4 that is so different in every way. They go from almost all
practical education to “chalk and talk” and although the level has to be higher on the
substance and the teaching there does not has to be boring. Because of this big difference is
there a risk that the attitudes till be negative and all the hard work at the earlier ages to prevent
that will be a waste. Because of this way of work at J3 and J4 there were a whole class of
students in need of extra help at another room every mathematic lesson.

8.2.2 Discussion: Materials that were used
Since the work with mathematics were primary practical at J1 and J2 there was a lot of
materials used during the lessons. They only used pencil and paper at J3 and J4 and TJ4
blamed the lack of time as well as that she thought that it was not necessary at that stage. TJ3
was saying that they did not have the time either, but she also blamed the economy at the
school and said that it was the lack of materials that also was one of the reasons to why she
was not doing any practical work. Rystedt and Trygg (2010) write that it is easy to make use
of ordinary materials gathered from the nature such as seashells and chestnuts for example
(2010) and it is exactly what the teachers in J1 and J2 does. They have the same economic
restrains as TJ3 but somehow has solved the problem and work with a lot of materials during
the lessons anyway. TJ2 described how they used the student’s lunch boxes and the contents
in them to weight, measure and compare. TJ1 used things in the classroom and outside as
examples when they had geometry. This shows that it is not all about the economy, it is about
the teachers own desire and engagement to work with practical materials. This is a shame
because there is often students that need that extra thing to fully understand and although the
students should be able to work without helping materials at the higher ages there still has to
be some kind of a bridge from the practical to the abstract. They should always be given the
opportunity to take help from different materials and methods if they don’t understand. As
Rystedt and Trygg (2010) write; there can be hard for some students to see the connections
and with helping materials it can be easier for them to understand, the lessons should involve
some kind of elaborative materials no matter what age the students are (2010).

At J1 and J2 they also incorporated board games into the mathematic lessons, which was a
good way to have fun at the same time as it was a learning environment. The basics can easily
be introduced when it is about reckoning and seeing patterns for example when they are
playing Domino or throwing a dice. But it is important that the games are used in a thoughtful
way (Rystedt and Trygg 2010) so that the students understand that the games have a purpose
more than being fun and think about what they are doing and how they communicate with
each other during the game. TJ2 told me that she had made different math games for her
students to take as homework to play with their parents and that they saw it as so much fun
and actually liked to get this homework once a week. But she also said that one of her
students once said that he couldn’t take the games home any longer because the parents didn’t
have the time. And when TJ2 said that it was homework and that he has to do it the student
was chocked and had not understood that it was important. This is one of the risks that
Rystedt and Trygg is mentioning when they are talking about using games thoughtfully, the
students need to understand the purpose in order to think about what they are doing.

According to Ahlström (1996) should the mathematic education be varied and contain
interesting approaches because it can affect the students learning regarding how they feel
about the subject (1996). This is something that the teachers at J1 and J2 most positive
succeed with by working in many different ways and were driven to make the subject fun for
their students. And it is here that the teachers at J3 and J4 fall flat because of the exam and the
fact that the students should be able to handle mathematics at a higher level. But it doesn’t
have to mean that they has to make it boring, this means that the two years they put on preparing the students for this important exam also can be the two years where the students attitudes against mathematics is getting negative and therefore maybe affects their learning in the opposite way than the teachers would like to.

8.2.3 Practical and/or aesthetic subjects integrated to the mathematic lesson

I came to understand that neither J3 nor J4 integrated any practical or aesthetic subject to their lessons with the explanations mentioned earlier. Their way of work is like Ahlström (1996) describes the quiet and individual and is often one of the reasons to why students find mathematic too simple or too hard because they don’t get their different needs fulfilled (1996). TJ1 and TJ2 had been taken the students different needs in consideration because as TJ1 said “children learn in different ways” so they were taking use of art and drama to give the students different angles to learn from to make it more understandable. Different methods because of the different learning styles make it easier to reach every student and its needs. Aulin-Gråhamn and Thavenius (2004) write that a theoretical subject can be made more enjoyable by integrating practical and aesthetic activities to it and by using art will the students work with the questions why and how instead of right or wrong and will therefore gain a better knowledge through the curiosity they are experiencing (2004). At J1 and J2 the students were making their own clocks where they in the process of making had to think about the numbers placing and the arms for hours and minutes. In this way they often remember which one is the long and short because they have colored and made them themselves.

The teachers did also organizes role play where the students were shopping at a small store they had built up in the classroom. In this way, the teachers were making the connection to the abstract mathematics and the reality clear. The students saw one of the many situations in real life where they will have to use their mathematic knowledge to know if they can afford to buy something, and so that they can be sure of getting the right amount of change back. This is a good method that TJ3 in other hand was not impressed by because of the more and more common use of just swiping a credit card these days. To take mathematical concepts from practice to theory gives the students a much more clear connection and helps the students to develop a mathematical thinking (Ahlstöm 1996) and by seeing the use of it will make them more positive to the subject. They understand on their own terms.

It can be much more of a challenge to work practical and aesthetic in the higher years, and TJ4 did feel stressed because of the exam. Both TJ3 and TJ4 were positive to the idea of working by integrating other subjects but they only saw the restrains that partly was for the exam and partly the lack of equipment and time. This means that their teaching was exactly what Ahlström (1996) says how it is not supposed to be; guided by the textbook, not interesting and does not treat the different needs (1996).

8.2.4 If it would enhance the students learning, understanding and willing to learn by using aesthetic subjects and more practical based lessons

Ahlström (1996) says that he teacher’s personal attitude against mathematics affects the student’s view of the subject more than many would think. It is the teacher who reflects the most of the willpower to learn to the students. The students approach to the subject is often a reflection from their teacher (1996). This is something that I came across from the first observation when I saw the teachers “in action” and the student’s behaviors. It was a clear difference between the grades and maybe it has to do with the different ages and which goals that has to be reached, but still. TJ1 and TJ2 were engaged in their student’s education and they used a lot of different methods and put down a lot of time planning the lessons to be as
good and giving for the students as possible, with a lot of different methods, styles and approaches available. They were energetic and it was clear that these two teachers actually think that mathematics is fun and interesting themselves. Ahlström (1996) says that when the teacher shows that mathematics can be fun, interesting and inventive will the chances be bigger that the students feel a desire to learn (1996) and this was truly shown by the students that were engaged and focused during the whole lessons even though they only were 7-8 years old.

When I came to J3 for observation TJ3 met me at the entrance to the classroom and apologized in advance because the lesson would be boring and just chalk and talk and nothing interesting at all and that some of the students would be noisy and move around, showing no interest. She said this in a volume so that everyone could hear her, and still today I don’t know if it was a trick to maybe make the students understand how she think of them and maybe they would behave or if she knew that what she did was not as good as it is supposed to be and were ashamed of this. She knew what my thesis were about and what I was going to observe. With this said was it clear that the students were bored, they looked sleepy and was indeed chatty and had a really hard time to sit on their places while TJ3 stood by the blackboard and talked during the whole lesson. She didn’t enjoy it, and neither did her students, to refer back to Ahlström that I mention twice above does the writer have a point in what he is saying. I saw the same thing at J4, except that she was moving around at the same time as she was speaking so that the students would do what they were told and she did wait to the interview with the apologize.

Although the extremely varied results on the observations the teachers had the same thoughts during the interviews. They all said that it was no doubt that practical and aesthetic subjects as tools to the mathematic lessons would affect the students learning in a good way. All of them were positive and admitted that the students would get a deeper understanding and that it is crucial for their desire to learn to work in this way. But only two of the teachers actually worked in that way, and the other two didn’t even try to work a little bit in that direction. They were bored by their own teaching and were aware of that the students didn’t enjoy it either and still they didn’t change anything. No time to plan the lessons and the stress were their answers. TJ3 could work more practical if someone else did the planning, she said.

Students learn and apply knowledge through the overall situation, learning takes place in many different levels and it is by interacting with each other in social settings they learn (Karlsson 1998). This means that the students have no chance at all to apply knowledge and learn even more in an as effective way as they have done at J1 and J2 when they come up to J3 and J4 where the more abstract mathematics takes hand and where the important test is getting closer. And the teachers know this very well. They know it so well that they felt that they had to apologize for their teaching styles to me. At J1 and J2 the students lay a solid foundation, ready to build their knowledge on and then they come up to the higher grades and has to deal with not only chalk and talk, they also has to deal with the stress and pressure that comes with the exam. Dahlin, Ingelman and Dahlin (2002) is talking about “play for learning” as an important method to be used in school, mainly for the de-stressing relaxation it gives to promote the students concentration, memory and therefore also learning. The play has to be designed so that the students have to use both their minds and their bodies, this can also work to take the pressure of when a subject feels difficult (2002). Something that the students maybe would need and an idea that the teachers maybe should have in mind.
9. Future research
For a future research I would like to see how students affects by having aesthetic and practical subjects as tools to their mathematics education during a longer amount of time to see if there are any significant differences. Maybe even work a while with only practical and aesthetic tools and then change to pure theoretical lessons just to see if there are that big of a deal to work in either one of the ways. What happens when it gets too much or less?
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