Mathematics in the History Environment

Tools in Life

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Preface

Berit Roos Johansson and Lena Westergren

How do we develop and improve education in Mathematics? This is the focus of a cooperation between universities, museums, schools and communities in Kenya and Sweden. The project “Mathematics in the Historic Environment” started in 2011 with Linnaeus University, Kalmar County Museum, Kenyatta University and National Museums of Kenya. A few years later also Maseno University in western Kenya became an active participant.

Meeting at Kenyatta University

There are both similarities and differences between Kenya and Sweden when it comes to mathematics teaching. Both countries look with concern at the descending knowledge results in Mathematics. The same challenge is when it comes to making students interested and motivated to take on the mathematical content. Teaching is often guided by the textbook. Many
students do not see the connection to everyday life and the benefits for their own lives and push Mathematics away from themselves. They have difficulty to pass on their knowledge of mathematics books to real context.

Kalmar County Museum (KLM) has for many years developed an educational approach, “Time Travel Method” or “Applied Heritage”, which has received positive recognition both nationally and internationally. We see the Time Travel method as an opportunity to challenge our own teaching to give teacher students additional tools to meet all pupils in school.

To try out the method, several sites have been used in both Sweden and Kenya. From these sites enactment of historical events were generated and learners were exposed to the expected process of learning Mathematics in a historic environment. The first pilot site was among the nomadic populations in northern Kenya. We had contact with this area previously and there was interest in developing mathematics teaching. It felt as a challenge to test the method in a completely different culture. We assumed that if it was successful there it would be sustainable even in Sweden and other places in Kenya.

This book presents how the work based on the Time Travel method has been planned and implemented at various pilot sites in both countries. Examples of planning and arrangements of different Time Travel events, undertaken with a focus on Mathematics, are described in certain chapters. The project is done in close co-operation between schools, universities, museums and communities. Joint research question for the project became: How can a better connection between Mathematics Education and Historical Environment provide a deeper mathematical and historical understanding and make the students realize that Mathematics and History can be tools in their own lives?

Funding of the project has mainly been through Linnaeus Palme funds. There has been teacher and student exchange in both directions.

We would like to thank everyone who has contributed to this book, project participants from universities and museums, community members in both Sweden and Kenya as well as schools in the network “Mathematics in the historic environment” in both countries. We hope the book can be used to spread the ideas of teaching and development of Mathematics.

Introduction

Mueni Kito and Mary Nasibi

In order to make learning interesting and lasting, there is a need to utilize the local environment which is familiar to the student. This is especially the case in the teaching of Mathematics to secondary school but more so to primary school pupils who need to interact with concrete things within the environment, in order to internalize unfamiliar concepts. The teacher should therefore devise suitable teaching and learning activities based on the local environment.

In using the Time Travel Method in the immediate environment, effort should be made to involve the local community and other stakeholders in the school neighborhood in the Time Travel activities. This enhances cordial relationship between the school and the neighborhood. It also enhances the understanding of the mathematical concepts.

The content being presented in this publication came as a result of Time Travel activities which were conducted at various institutions and organizations in Kenya and Sweden; universities, museums, schools and communities. Participants involved were given time to organize themselves for Time Travel activities. Meetings were also held to review and plan for a way forward. Both the learners and teachers in the affected schools gained a lot in teaching Mathematics using the Time Travel method.

Interaction between the teachers and organizers of Time Travel activities provided a rich opportunity for sharing their experiences in teaching Mathematics in a historic environment. The activities and learning experiences gained in the Time Travel method have been selected for inclusion in this publication.
It should be noted that the highlighted Time Travel events are by no means exhaustive. They are only suggestions indicating the direction in which the Mathematics teacher of the 21st Century and beyond can use the local environment of the learner as a basis for meaningful learning.

The examples presented in this publication therefore need to be adapted to suit the needs of the learners. It is also suggested that the teacher makes use of other relevant methods and resources for variety in order to make mathematics lessons interesting. This publication suggests the idea of using the historic environment as a method of enhancing or strengthening the teaching of Mathematics.

Possible causes and effects of poor performance in Mathematics

**Possible causes of poor performance in Mathematics**

The tree starts with the possible causes of poor performance in both Kenya and Sweden which are teacher, learner, content and resource based. The teacher based causes relate to teacher incompetency in terms of skills and content. The methods used are teacher-centered as opposed to participatory approaches where learners directly interact with learning materials and content, owning learning outcomes. The teachers teach abstract content without relating it to what learners can relate to in the environment. Although the teachers assume they have taught and covered the syllabus, in reality the learners end up understanding very little and therefore not attaining the expected level of competence. Expository approach is adopted more easily when one considers large classes in the case of Kenya.

The Kenya present curriculum is examination oriented which has a direct effect on how teachers teach. The instructors tend to focus more on the content which is likely to be examined at national level. They teach for examination rather than for life, encouraging rote learning at the expense of understanding and application. Apart from the above the learners have a problem of learning the English language which is the language of communication and also learning the Mathematics concepts which in most cases are poorly presented. It is partly because of this that the subject appears difficult.

**Effects of poor teaching in Mathematics**

The above problem factors contribute to low motivation, lack of interest and negative attitude towards learning Mathematics. Gaps are created in mathematical knowledge, leading to poor performance not only in the subject but also to related disciplines like science.

**Time Travel approach**

Learning from the environment makes learning more attainable. The learner finds meaning in what goes on in school by relating it to what is taking place in the environment around him/her. This enables him/her to connect education to their lives and their communities and thus developing communities based on learnt knowledge (experiences) and skills. The Time
Travel approach is seen as an intervention in addressing the issues cited above. It should be pointed out that the Time Travel approach does not suggest that learners will acquire superficial learning. On the contrary it suggests active involvement of the learner in the teaching and learning process. It also implies that active learner participation in the learning process thus enhancing development of a variety of skills.

Time Travel approach as an intervention strategy of teaching Mathematics has brought in to focus how History can be a vehicle of teaching Mathematics. Although human speaking the two subjects look world’s a part, this project and other experiences have shown that the two are intertwined. History has been known as the mother of all disciplines because no subject exists outside its historical perspective. Every subject has an origin which is embedded in its cultural setting, its history. The two disciplines are also similar in the importance they put on logic or critical thinking in solving problems. Logical steps are followed in solving societal problems or mathematical problems.

The dichotomy between History and Mathematics can be traced to the beginning of humanity when people attempted to interpret their environment. Mathematics was seen as a human activity and comprehending it meant appreciating and understanding the culture which created and nurtured it. It is further argued that the mind of the individual within a specific culture is true location where Mathematics exists. This is evident in this project because the cultural artifacts, the ornaments, the architecture of some of the participants exhibited mathematical concepts and patterns and became ready tools/resources of teaching Mathematics in that environment, thus linking the abstract world of mental mathematical concepts to the real world making learning meaningful and relevant.

The Time Travel method – Education in Action

Ebbe Westergren

A boy and a girl in the Rendille and Samburu community of Ngurunit, Marsabit County, Kenya, are leaving the community to study at a university in Nairobi. The last day in Ngurunit many friends and relatives gather at their manyatta (settlement) to say good-bye. Almost everybody wants to give some good advice to the young ones when they leave this small rural nomadic community for the big city. What are the traditions and customs we want them to remember and keep from our community? Is it clothes, food, handicraft, building huts, songs, games, language, ceremonies? Do we want them to keep the Rendille and Samburu social structure, gender roles, decision making and hierarchy? Or are there any customs we’d rather want them to leave? The manyatta is full of life today, traditional craft is practised, a hut is constructed, games and sport are played. There is singing and dancing. Some make necklaces, a woven mat and even drawings of the manyatta as gifts to the two young persons. And of course tea and food are cooked on the fire. At the end many express their advice and hand over the gifts.

This is an extract of the scenario for a Time Travel event in Ngurunit 2014, an educational event to reflect and learn. The topic in this Time Travel is traditions to keep, traditions to leave, a “hot” topic in the Samburu/Rendille community. While using the heritage and reflecting on an important contemporary issue, the pupils and participants are able to show their understanding of various mathematical elements and concepts.

The participants, a mix of pupils from the two primary schools in Ngurunit and community members, reflect and discuss in small groups and together; talking and working with their hands at the same time. And through the activities, for example craft, games, dances, food making, constructing a hut,
drawing, they use a lot of mathematics. Mathematics becomes a tool in their daily life.

*A workshop on the teaching of Mathematics in the historic environment in Ngurunit*

**What is the Time Travel method?**
The Time Travel Method is an educational method that uses the local heritage for learning and for reflection on contemporary issues. The Time Travel event is a role-play staged at a (heritage) site in the local community, for example a manyatta, based on a story connected to the site. In the event learning areas are created for activities and reflection on the chosen important issue. Any contemporary issue can be in focus, traditions and customs, as in Ngurunit; other common topics are gender, democracy, conflict, communication, education.

The Time Travel mostly has an interdisciplinary approach, several school subjects are involved. In the Ngurunit example the focus is Mathematics, using the daily life and heritage of the participants and the community. The pedagogy is based on a relational and experiential learning process, reflective dialogue, and using of the whole brain. The goal is to promote learning, social cohesion and contribute to community building.

*Women build a hut in a manyatta, from the Time Travel event in Ngurunit, Kenya*

The Time Travel event in Ngurunit is part of the project Mathematics in the Historic Environment. Before the Time Travel event, there were several workshops between community members and teachers in Ngurunit and the universities and museums from Kenya and Sweden involved in the project. Teaching of mathematics was discussed in the workshops as well as important places in the community. Finally, the manyatta was chosen as a heritage site and a story developed where mathematical tasks from daily life could be expressed. The pupils prepared in school, interviewed relatives and community members on life in a manyatta and traditions in the community, and were well equipped for the event. After the Time Travel, teachers and pupils discussed in school what mathematics they learnt but also the heritage and customs in the community.

**Where did it start?**
The Time Travel method started in Kalmar, Sweden 30 years ago as a way of teaching local history at school, cooperation between Kalmar county museum and local schools. After some years the local communities were also involved and contemporary issues were connected to the event to make it more meaningful. Since the early 1990s Kalmar county museum is organizing about 100 Time Travel events together with local schools and communities every
year, at local sites close to the schools. Every site and event has its own story, its own topic and is always connected to and supporting the school curriculum.

Some sites and stories are recent, some are hundreds, or even thousands of years old. Many workshops and trainings for teachers and community members are organized. Several school subjects are included.

**Bridging Ages**

In 1999 Kalmar county museum was invited to go to Finland and to Minnesota, USA, to introduce the Time Travel method. More countries followed. In 2004 the network Bridging Ages was formed with organizations and persons from eight countries. In 2007 Bridging Ages was made into an international organization on Historic Environment Education and Time Travels.

The Time Travel method was introduced in Kenya in 2004 but it was not until 2011, when representatives from Mathematics Education at Linnaeus University, Kalmar, Sweden, asked for cooperation in Kenya, as the Time Travel method took off in the country. Kenyatta University, National Museums of Kenya and later Maseno University and Marsabit County Government were involved.

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*Bridging Ages includes people from museums, universities, schools, communities, NGOs in about 25 countries on four continents. In 2014 the Bridging Ages annual conference was held in Ngurunit, Kenya with almost 200 delegates from all over the world.*
There are university courses or modules within courses on the Time Travel method in several of the Bridging Ages countries.

**The 5 principles**
There are five principles in the Time Travel method:

- **Local sites** close to the school, and stories connected to the site, are used. Make it simple and use a building or a site close to the school for the Time Travel event. Even the school itself or the schoolyard can be utilized. Find an interesting story connected to the site.

- **Contemporary issues connecting with the past** are central. This is expressed as key questions to discuss in the event. Focus on one of the issues discussed in society today, among the pupils. Connect the story of the site with this issue. For example, traditions to keep or to leave (Njurunt), creating the good society (Funkabo, Kalmar). There are several examples in this book. And of course it needs to be linked to the curriculum.

- **Several partners** work together, often schools and local community with support from museum or university. There are many advantages to work together when you organize a Time Travel event. It gives more knowledge, more engagement and it is also enjoyable.

- There are always **several perspectives** to a story, depending who is telling. This should be reflected in the preparations and in the Time Travel event and gives an understanding of various viewpoints. Most of us are “ordinary” people, so the main perspective in the Time Travel is this “bottom-up approach”, including of course views from children, women and men.

- A **reflective dialogue** between the participants is essential, in preparations, event and follow-up. In the dialogue, both in the classroom and in the event at the site, you have a chance to listen, argue and reflect and come up with alternative solutions to the problem. In the Time Travel event you create learning areas so that everybody is able to contribute with their opinions and ideas.

**The Time Travel Method, process and event**
The Time Travel method consists both of The Time Travel process, that is the preparation and teaching in school before the event as well as engagement with the local community, and the Time Travel event, the role play at the local site. Proper preparations are an important part of the Time Travel method. The process includes several components that could be used in sequence, combined or separate:

- **Decide topic and objectives**, problem to address
- **Involve partners**, Parents, community members, elders are often positive to support the school with knowledge and skills.

- **Identify a local site** close to the school and an interesting story connected to the site.

- **Gather knowledge, research**. A museum, university or a local heritage group might be able to help. The pupils can also do some research, for instance interview key persons, parents or look into documents.

- **Write a scenario**. The scenario is a fictional story based on facts, a certain year, a special event at the local site. It is mostly written by the teachers and museum/university staff together. The pupils might add some elements to the story. In the planning document for the scenario you state the objectives, topic, story, roles, key questions, activities and time-plan. See examples later in the book. The scenario opens for conflicting views, a problem to solve, with alternative solutions. Remember that everybody keeps their age and sex in the event, so you need to find a reason why so many of the same age is part of the story.

- **Capacity building, training**. Museum, university staff or other experts can give training in history or education.

- **Education in school**. Most often several subjects are involved linked to the curriculum and syllabus. The pupils study, research and make interviews to understand the topic, story and problems. They might create the character they play in the event, persons of their own age and sex. They are well prepared for the event.

The Time Travel event is the highlight of the whole process. It is a role-play/dramatization of an event staged at a local site within the community. Everybody is actively participating in the event, pupils as well as teachers and other adults. There is no audience. People might even be dressed in clothing of the time. The Time Travel event is a drama with a considered dramaturgy. It has a clear start, an initiation ceremony. Then the participants are given the task of the day and are divided into smaller groups with activities connected to the task. It is important that everybody is active in the activity and in the practical work; nobody is just watching. In these groups the participants work and discuss at the same time and try to find solutions to the given task. Young and old work together. There is a leader in each activity and also a leader of the whole event. At the end of the event all groups come together, present their ideas and hopefully find common ways forward. The Time Travel ends with an ending ceremony.
The event is immediately followed by an evaluation, to find out about the learning that has taken place, if the goals have been achieved and compare the topic with today. This evaluation continues in school the following days.

The learning in the Time Travel event is based on relational and experiential learning (Rueben Gounden, Educational manual, in print). The relational process means listening to each other, share ideas and together create new knowledge. It involves dialogue, discussing and problem solving. In the Time Travel event the smaller groups are learning areas, where you discuss and work with your hands. As mentioned above, most often the groups present their solution for the others at the end of the event.

Experiential learning is a method of educating through concrete experience and experimentation - learning by doing and reflection. The whole person is involved in the Time Travel event, intellect, senses and feelings. You combine practical activity with the brain and mind, in order to deepen the learning process, give insight and understanding.

The emphasis in the Time Travel event is a contemporary issue. This is expressed in the key questions to make the participants reflect, discuss and find solutions. Examples of key questions are: What are the traditions to keep? What are the traditions to leave? (Ngurunit 2014). What is the best way of communication/ transportation, for me, for the community, for the environment - cars, trains, ships or airplanes? How do we improve communication between different groups of people? (Kisumu railway station 1972). How do we create the good society together? (Funkabo apartment houses, Kalmar 1958)

Conclusion
The Time Travel method is a way to deepen the learning process, to make it more meaningful and connect it to everyday life. Sites and stories in the local community are used, sites that the pupils might see most every day. The method is well suited for an interdisciplinary approach with several subjects involved.
Teaching Mathematics in a historical environment - A pedagogic method based on the Time Travel approach

Marguerite Khakasa Miheso

Mathematics has been used by generations to make important decisions for a long period of time. While History of Mathematics focuses on what each culture contributed to present day Mathematics as a subject, Mathematics in a Historic environment focuses on identifying mathematical thinking that exists in all historical events. Historical events which are enacted through the Time Travel approach discussed early in this book gives learners opportunity to relive past events. To relive these events costumes from museums and artifacts of the time in question are used to provide solutions with present thinking. The tasks that participants are engaged in through reflect activities that took place at the event time; they are crafted to illuminate mathematical skills and processes.

Learning Mathematics tends to give undue emphasis on the role of number systems and insufficient attention paid to what Gerdès (1997) describes as “frozen Geometry.” These would include geometric or logical relationships embedded in diverse activities such as basket weaving, knitting, and sand, or ruins and monuments. These mathematics tasks which in part represent what Asher (1998) call ‘ethno mathematical activities’ since it focuses on determining their historical origins are the central reflective points of discussion after the Time travel event. Mathematics exists in different forms which offer a rich repository for teachers and students. According to as Rambane and Mashige (2007, 184–85) the following list identifies sources of mathematical references;

1. Oral Mathematics. The mathematical knowledge that is transmitted orally from one generation to another in story and song. One
example that is commonly discussed orally is the problem solving the challenge in which a farmer, a goat, silage and a leopard have to cross a river using a boat that can carry only one item besides the farmer. With the catch being that, the goat eats silage if left together and leopard can eat the goat if left together. The challenge is for the participants to explain how the farmer will get all the items to cross the river safely. This classic African story explains a fun learning method that is powerful yet none threatening. The story which can be culturally contextualized for any historical event inspires the thinking of the Learning Mathematics in a Historical environment pedagogical approach.

2. Oppressed Mathematics. These are the mathematical elements in daily life that remain unrecognized by the dominant (colonial and neocolonial) ideologies (Gerdes 1997). These mathematics that include counting and geometrical systems of different cultures can be used to provide a sense of ownership for thinking mathematically. These oppressed mathematics from the roots of conceptual learning of conventional mathematics theories. Oppressed mathematics is not dead, it is alive and used every day outside the classroom. Mathematics in historic environment brings this mathematical thinking to the fore and relates it to the school curriculum hence adding meaning to the school Mathematics.

3. Indigenous Mathematics. A mathematical curriculum that uses everyday indigenous Mathematics as the starting point according to this concept. Indigenous Mathematics is historical and can be found in many historical sites and artifacts. The use of indigenous Mathematics personalizes the experience of learning mathematics theories adding meaning to what learners consider abstract. Abstractness of mathematics in Mathematics for historic environment (LMIHE) represents teaching concepts that are detached from cultural knowledge.

4. Socio Mathematics. This represents the applications of Mathematics in the lives of people, and, conversely, the influence that human institutions had upon the evolution of their mathematics (Zaslavsky 1996). This section of socio Mathematics is discussed as a reflection of the mathematics they experience in the enacted event when dealing with LMIHE.

5. Informal Mathematics. Mathematics that is transmitted and learned outside the formal system of education, sometimes referred to as “street mathematics”. This informal Mathematics forms part of LMIHE when participants can use the opportunity of observing people and recording their activities especially those that are related to their culture of past events.

6. Nonstandard Mathematics. This distinctive Mathematics which is beyond the standard form, found outside the school and university. In LMIHE this form of Mathematics brings to fore the existence of Mathematics in the most unexpected forms.

7. Hidden or frozen Mathematics. Mathematics that has to be unfrozen from “hidden” or frozen objects or techniques, such as basket making, weaving, or traditional architecture. Frozen Mathematics forms the subject of LMIHE and can be used to relate to a concepts or concepts. Basket weaving can be used to teacher computations (counting), sequences and series, geometry, symmetry, statistics, and probability effectively.

However, for participants to be able to engage in these learning experiences, a Time Travel event must precede the discussions and reflections. The Time Travel approach and its elements when combined with LMIHE conditions form a rich repository for learning. The following section foregrounds the genesis of Learning mathematical in a Historic Environment.

Time Travel learning approach which has been discussed elsewhere in this book considers five main key points

1. Local Sites and Stories
2. Several perspectives
3. Key Questions of today and the past
4. Together
5. Dialogue

During the time travel, a historical event is reactivated by learners in exactness in terms of costumes, food processing, economic and cultural thinking of the time event. The historical event follows a script that provides a background of the event that will be enacted within that historical moment. The activities that the participants engage in have an embedded mathematics component.
Learning Mathematics in an historic environment is rounded in how we view the world. There is a constant struggle between world views which Kristensson Uggl a calls” the battle of reality” (Kristensson Uggl a, 2004). According to Uggl a, past and current stories create our world views which are variable and interchangeable.

From a philosophical perspective as humans we are constantly meaning making of a jumble of experiences (Bruner, 2004). We arrange events into life controlling or life mastering meaning structures that are fundamental for our survival. Through stories we edit life: what is important and what is not important what is cause and what is effect. This forms the source of historical events. Events follow upon events since everyone is born into a life story, gender story, a national identity (Taylor, 1989). Through these stories we create our world view which contains truths, values and moral positions that need to be confronted by pedagogical perspectives based on learning as the transfer of as digested information. Such a chance allows opportunities for reflection about uncertainty and the acceptance of a multiplicity of truths and perspectives (Bishop 1998). An outcome of this can be reached by illustrating how events, historical sites are interpreted from different angles.

The assumptions of LMiH E are that historic sites/places and the stories attached to them could be staged as arenas for meaning-making and that by immersing oneself into the event that provides actual experiences, it is possible for one to take a reflective position. Since kinds of stories told affect us differently, different stories can be told about the same site and place hence affording a rich pedagogical source for any subject in the school curriculum. The main key concepts that can be supported through this learning approach are critical reflectivity and problematizing. These are concepts that have been adopted and extended under the project on Mathematics in Historic environment. Critical reflectivity according to Birgitta E. Gustafsson (2011) implies cultivating the ability to respond to daily living from a variety of standpoints and tolerance of differences and respect the right to be different, fortifying critical and self-critical faculties and their consequences. These are virtues of that are promoted in reforms of mathematics learning ; The opportunity allows for training in the capacity for changing the frames and resisting the temptation to escape from freedom with the anxiety of indecision it brings alongside joys of the new and the unexplored (Bauman, 2001, P.138) this a desirable outcome of learning mathematics.

Learning Mathematics in historic environment provides learners with opportunity to deepen their reflective and critical ability and ask how stories at historic sites can be used to this end and how stimulating learning stories can be staged in order to increase the opportunity for learners to gain new imaginative and self-reflective powers to reframe assumptions. When problematizing, the explanation of the past at historic sites affects both the content and the perspective created by the dominant story.

It is important to realize that all stories trap us and we need to be aware of the entrapment and reflection on this entrapment is critical. The time travel activities that are enacted have specific mathematical implications. Some are directly linked to skills that are reinforced through the enacted event while problem solving forms the central session for reflection and thinking. Other mathematical processes that occur naturally with this method include communication, representation and connections.

Mathematics in historic environment methods aims to interest teachers and students in reflecting on the role of Mathematics in the decisions that are made in the selected event. These sessions are based on the premise that Time travel method can promote reflective thinking and metacognition among learners and teachers. The method has been observed to reach all learners and allows ALL the learners to participate while at the same enables the transmission of desirable cultural values through enacting lived experiences. Teachers on the other hand find a effective method for consolidating learned concepts in class and increase meaning making for learners. This is a fresh pedagogical approach that has a social constructivist theoretical orientation. According NCTM (2000), Mathematics is one the greatest cultural heritages of mankind.
Learning Mathematics in a Historic environment promotes culture meta cognitively using collaborative and team teaching skills.

The pedagogical framework - LMiHE
A pedagogical framework, Learning Mathematics in a Historic Environment (LMiHE), has been developing since 2011. Although the idea was generated from the Time Travel Method, see Chapter 2, the approach has evolved to the extent that the method generated around the intended concept meaning making.

The project aimed at developing mathematics activities embedded in historic situations use the activities to promote mathematical process skills such as problem solving, communications connections, representations, reasoning and proof among learners through time travel experiences. The study also aimed at using the LMiHE to promote actual collaborative and team work across classes’ subjects, schools and nations. The project uses the Time Travel process as a teaching method in Mathematics education and relates History and Mathematics for better understanding of the two subject areas and use of heritage to reflect on our world views.

When using a Time Travel approach to teach Mathematics certain aspects must be taken into consideration in the event.

1. The Time Travel event is scripted
2. The participants work in groups on Time Travel with specific tasks that are related to the curriculum
3. The participants report on group tasks and their experiences,
4. The participants then reflect on the relevance of the tasks of learning mathematics
5. There has to be an evaluation of the Time Travel event with the aim of improving it

When mapping the activities to the curriculum, it is important to reflect on the event from a mathematical focus for learning different mathematics concepts. This has to be followed up in the classroom. The teacher is very important for all students to get math challenges at their own level and must therefore be an active and responsive participant. Students must have sufficient knowledge to deal with the mathematics in the activities. The teacher must have taught them that even if they not lift the mathematics content until afterwards, back in the classroom.

Evaluation
After each Time Travel event, an evaluation is made with learners and teachers. Feedback from the participants indicates that learners rated the event as a fun way of learning and reiterated that they were able to get a better insight mainly because they experienced it for themselves compared to just words in books. The participants also confirmed that thinking about solutions and discussing alternative methods was fun and exciting. Participating learners identified the missing link when working with only books and supported the need to have this experience mounted for this subject to improve conceptualization and add meaning to concepts.

The ability to calculate and measure for a purpose was the main difference. The work with Mathematics that evolved as a solution process to a task is the central difference between this method and others. For example in one task which is discussed elsewhere in this book an oil consignment meant for delivery in a historical time engaged learners to measure, estimate, count, package and estimate time to deliver the goods using equipment of the time. In one moment participants had to decide shape and quantity of oil per bottle, the number of bottles of oil required to fill one box and how many boxes required to fit in a container and how many containers needed to be shipped in this cargo ship to meet the needs of the customer. Participants asked questions, discussed different approaches working as a team, building consensus, working with volume, capacity, density, statistics and probability.

These are some examples that make this approach very powerful. Based on the learners' level, students still ask questions and decide on solution processes. In a case of fencing the school yard to find a solution to the task, students needed to work with numbers and costing in trying to make sense to what they had learned theoretically in the classroom. To fence, students asked questions like, “what fencing material is needed? How many posts will be required for the perimeter? How do we find the perimeter? How much will the material cost? What will be the distance between the posts? All these questions elicit active learning. To do this, learners need to measure, calculate perimeter and use materials of the historical event and estimate costs based on the currency of the Time Travel event. Learners get to appreciate the need to estimate measurement and reflect on how the same problem best could be solved in the current status.
This intensity in mathematical engagement was made possible by the time travel event focusing on Mathematics. Some of the experiences that learners appreciated include the opportunity to work with tools that were used during the historical time of event, ability to use own body to make estimates, the opportunity to observe how mathematics works in daily life and to connect theory to practice with reject to mathematics concepts.

Some reflections on the Time Travel indicated that learners experienced thought processes that go into decision making in a way that made learning of Mathematics important. Some of the concepts that had been learned in class were used effectively and this added meaning to what learners had assumed was meaningless learning of numbers and symbols. Although they appreciated that this learning environment breaks the monotony of the classroom, they recognized that this was an innovative learning approach and links the importance of Mathematics then and now and how decisions that respond to mathematical concepts are reflected in the cultural progression.

Way forward
Deliberate effort to scale up Time Travel sites and to help teachers contextualize the Time Travel for learning Mathematics provides an opportunity to improve the strategy and document the learning experiences.

This can be done by mainstreaming the approach for teacher education and increase collaboration between the stakeholders in the education sector and museums for policy and monitoring. Documentation of the mathematical tasks for speckled Time Travel events will support and harmonize teachers understanding of the approach; we need to promote Time Travel method across the curriculum.

The development of mathematical knowledge demands new ways of teaching it. Modern Mathematics has developed into a worldwide language with a particular kind of logical structure. It contains a body of knowledge relating to number and space, and prescribes a set of methods for reaching conclusions about the physical world. And it is an intellectual activity which calls for both intuition and imagination in deriving “proofs” and reaching conclusions. Often it rewards the creator with a strong sense of aesthetic satisfaction and this is what learning Mathematics in the historic environment aims to support.

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Mathematics as a tool in applied heritage - History and Mathematics together

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There is a need to develop the teaching in Mathematics to reach all students, both those in mathematics difficulties and those with an aptitude for Mathematics. Mathematics arouses emotions. Some people do see beauty in Mathematics, others experience frustrations. According to the Swedish curriculum (Skolverket, 2011) it is a teacher’s assignment to catch all pupils, despite their divergent interests. This requires creativity and courage of the teacher. Teachers need to challenge their own teaching to give all students the opportunity to demonstrate understanding in motivating and interesting activities, based on their different experiences. This was the background ideas for an international development project initiated by the Mathematics Education at Linnaeus University in collaboration with Kalmar County Museum (KLM). Common starting points in Sweden and Kenya are that Mathematics for many students are experienced not to have anything to do with their own lives. Many teacher students testify this as they relate to their own school education.

In a Time Travel inclusive learning environments are created where contemporary issues, interpreted in a historical context, are discussed while doing practical work. Everyone's experience is seen as a resource and every individual is important as bearer of a cultural heritage. Reflection and communication are central parts. The Time Travel method is used in many different community development contexts and with people of different ages and in different cultures. The approach is generalizable and can be based on different subjects, but we focus on Mathematics.
The purpose of teaching History is that students will get an understanding of their own lives today (Skolverket, 2011). The teaching of Mathematics has a similar purpose; the students will acquire tools for life in today's society (a.a.). Mathematics is inserted into a historical context for students to get an overall experience and a meaningful learning to create motivation and interest. It is important to create arenas where all students can meet and get challenges. According to the Swedish Education Act all students will be given the opportunity to develop, based on their own conditions, students in mathematics difficulties as well as students with aptitude for Mathematics. Based on historical knowledge a scenario is formulated with activities adapted from the current group of students. Mathematics is used as a tool and depending of the chosen activities. The mathematical content is varied and based on the curriculum. By actively participating students are given opportunity to show their mathematical abilities and their mathematical understanding.

What is important knowledge? We have to look into the curriculum. Schools in Kenya have different conditions comparing to Sweden, therefore they sometimes face other challenges then the Swedish schools. The curriculums in Kenya and Sweden have been analyzed from the approach “Mathematics in historical environment”. The Time Travel method seems to fit the curriculums in both countries. Below are some examples from the Kenyan curriculum (Kenya institute of Education, 2002, page 2-4).

- Equip learners with knowledge and skills which assist in developing logical thinking, ability to apply the knowledge acquired, analyze situations and make rational decisions (page 2)
- Acquire an understanding of numbers and numeration (page 3)
- Identify and use relevant operations in everyday life (page 3)
- Develop spatial concepts and ability to use them; ... Identify common properties of various shapes in their environment (page 3)
- Apply spatial concepts in everyday life in: laying out rectangular fields and circular tracks, planning a farm and planting seedlings... (page 4)
- Acquire techniques of collecting, representing and interpreting data (page 4)
- Develop positive attitude towards mathematics and make use of leisure time: Discover and make patterns, make models and toys, play mathematical games and participate in relevant activities such as rhymes and songs. Relate mathematics to desirable experiences in everyday life (page 4)
- Develop techniques of investigation and problem solving strategies (page 4)

Often it is not these above abilities that are assessed but a more detailed knowledge. Those “ingredients” are also important in problem solving but we must not be satisfied with superficial knowledge.

Why do many people find Mathematics difficult and of no interest when the topic is important and necessary for Community Building? Attitudes to Mathematics need to be changed. Many people have a narrow view of Mathematics and think that it is all about counting and to complete tasks in a mathematics book. But Mathematics is also about beauty of the environment. The teacher is here very important to change the attitude to the subject.

How can Mathematics be raised so it becomes tools for everyone’s own life? The Time Travel process is a viable method to let students show their knowledge in different situations, sometimes outside the classroom. The knowledge that students "own" they are able to use in new contexts. An example: When the students is going to solve a task in the math book, for instance calculate the area of a field, they realize it can’t be solved with addition, not subtraction nor division. It has to be multiplication and they take length times the width. Then the students only show their skills of multiplication. The teacher does not know at all if the students have any idea how large the area is in reality. If the teacher instead sometimes leaves the mathematics books and conduct calculation outdoors students can get an idea of the concept of area, what is means to “take the length times the width”.

Teachers have to listen to their students and allow them to demonstrate their knowledge, not only listen to the teacher but communicate with other students. Then the teacher can get an idea of what students already know and what concepts they use. Every student contributes based on his own context and then the teachers build the lessons upon the students' demonstrated knowledge. The students realize "I am important in the construction of knowledge". This contributes to deep knowledge rather than surface knowledge. When you own the knowledge it can be picked up, when needed in different contexts. The students are able to reflect, communicate and put their thoughts into words. A competent teacher raises what should be learnt and use the opportunities available in the activities and artifacts for example in a Time Travel event. Competence and creativity interact in the learning.

Mathematics in Time Travel events
Some of the Time Travels have been conducted for training purposes in teacher education and some with students in primary and secondary school. No Time Travel is ever the same, depending on the participants’ age, sites, the story of the site, selected activities etc. Sometimes you have special artefacts and clothes for easier adapting the feeling of a special year.
Common for all Time Travels conducted with focusing on Mathematics is that the activities are permeated by problem solving associated to real life. While activities are ongoing, communication takes place around the key questions. Mathematics and History are interwoven. Regardless of the year and which story is used the participants are themselves. Their own lives are in the center. Everyone’s thoughts are important, which can affect motivation and the feeling “I can, I’m important and I dare”. The teacher is very important for all students to get mathematics challenges on their own level and must therefore be an active and responsive participant. It is difficult for a teacher to assume all the students’ individual interests. Instead the Time Travel method creates a common experience to refer to. As mentioned in previous chapters it is important that the Time Travel will not be an isolated event but inserted in a context. A Time Travel event can be an introduction to a work area, as part of an ongoing or at the end, but it will not be a single "happening". The preparatory work and the after work must be done in the classroom with a clear link to the curriculum.

Is the Time Travel method in line with the curriculum?

The activities are based on the current site and its story. Mathematical content to be focused on is determined on the basis of the current group of students. All students, both those in difficulties and those talented, need to be challenged on the basis of their ability. The teacher is aware of what Mathematics is included in the activities, but it is not pointed out for the students. Mathematics becomes a tool when the students reflect and communicate about the key questions during the Time Travel. All students are active participants and contribute based on their experiences and their own conditions. The activities in a Time Travel provide an opportunity for the students to explore mathematical ideas in their local environment.

How can the students demonstrate their understanding? The teacher needs to observe:

- How do the students take on the mathematical problems in the activities?
- What mathematical forms of expression do the students use?
- What solution strategies are they using?
- How good is the students’ ability to assess the reasonableness of the calculations and estimates?
- What concepts do they use?
- How do they communicate their thoughts?
Every Time Travel must be followed up in the classroom. The Mathematics in the various activities will be focused. Based on these reflective conversations and the teacher's observation during the Time Travel the continuation of Mathematics teaching in the classroom is planned, regarding to different students' needs.

References

heritage sites to integrate learning. In Kisumu, Time Travel events bring primary, secondary and university students together with personnel from the local museum, university, religious communities, Ministry of Education officials and the county Government officials. The Kisumu region Time Travel events had their focus mainly on Mathematics hence the concept of Mathematics in the historic environment. The concept of Mathematics in historical events is not new, as the literature that follows will show.

Copeland (1992) published a guidebook on Math’s and the Historic events. He indicated that his focus was on Math’s, which is not just a classroom subject, but an all-around Math that is both in the natural world and in the structures man has created. In his book, he explores the problem-solving aspects of mathematical processes when applied to the historic environment. It is designed to help teachers attain the maximum from a visit to a historic site or building. His approach is similar to the approach fronted by Bridging Ages in its use of the Mathematics in the Historic Environment. English Heritage (2012) prepared a handbook on Math’s and the Historic Environment with useful resources for mathematics educators. This is a practical guide with information, activities and resources for those wishing to use the historic environment to inspire Math’s based activities. The activities in this guide book cover mainly geometry, measurement and statistics. This is a very good reference to aid mathematics teachers who may wish carry out Time Travel activities on choice of mathematical activities that would fit within the historic event under study. Kim (2012) in his book, Mathematics and the Built Environment, explores how throughout history a rich and complex relationship has developed between Mathematics and the various disciplines that design, analyze, construct and maintain the built environment. This book shows the inter-relatedness of Mathematics and architectural designs in the built environment like houses, bridges, dams, etc. It is interesting to note that Mathematics in the historic environment as practiced in the Time Travel method includes but is not confined to the built environment. This means that the current study of Mathematics in the historic environment is much wider and deeper in scope as compared to Kim’s idea. But Kim (2012) is a good proof that teaching of Mathematics must consider the child’s environment. The Time Travel method expands on this by widening the environment beyond the built environment to the socio-cultural environment of the learner based on their history. Furthermore, Ostwald & Vaughan (2016) in their book “The Fractal Dimension of Architecture”, a book in the Mathematics and the Built Environment series, investigates eighty-five buildings that have been designed by some of the twentieth-century’s most respected and celebrated architects. Starting with 625 reconstructed architectural plans and elevations, and including more than 200 specially prepared views of famous buildings, this book presents the results of the largest mathematical study ever undertaken into architectural design and the largest single application of fractal analysis presented in any field. The data derived from this study is used to test three overarching hypotheses about social, stylistic and personal trends in design, along with five celebrated arguments about twentieth-century architecture. Through this process the book offers a unique mathematical insight into the history and theory of design. It is a resource teachers can use within the context of Mathematics in the Historic environment especially where the Time Travel activity is carried out in old buildings. Learners could relate classroom Mathematics to design of these buildings. Molyneaux & Stone (2002) summarizes these issues in their book by stating that the presented past is concerned with the differences between the comparatively static, well-understood way in which the past is presented in schools, museums and at historic sites compared to the approaches currently being explored in contemporary archaeology. It challenges the all-too-frequent representation of the past as something finished, understood and objective, rather than something that is constructed and therefore open to co-existing interpretations and constant re-interpretation. This fits in well with the processes followed by practitioners of Mathematics in the historic environment when used in a Time Travel activity. It clearly demonstrates the existing relationship between classroom Mathematics, Archeology and History. It also confirms the need for teachers working closely with the museums and the universities because museums are owners of the archeological resources and environments used in Time Travel activities, teachers are practitioners who use the resource in teaching and learning, while universities are research centers where Novell methodologies like Mathematics in the historic environment would be studied for viability as an academic discipline.

The Western Kenya branch of Bridging Ages in Kisumu has carried out a number of Time Travel activities with a focus on Mathematics. All their events focused on Mathematics in the historic environment. At the railway station; learners, teachers of Mathematics and History together with museum and university personnel explored mathematical topics such as money, selling and buying, measurement, geometry and symmetry; all within the context of historic environment based on the opening of the East Africa Railway station in Kisumu, Kenya. The learning outcomes from this single event were huge: most of the participants heard the historical account leading to the opening of the railway station for the first time; the learners were able to relate mathematical concepts they had been learning in class with day to day real life activities; the different professional in this event decided to formalize an association that could help them bring together, the university, museum and schools for future collaborations.
The second Time Travel event was held at Maseno University with participants that attended a Math camp. The historic event used in the Time Travel was the opening of one of the oldest schools in Kenya that was an exclusive boys’ school. Mathematical concepts explored in this event included how to practically identify the equator which is actually an imaginary line running across the earth. In Geometry, learners explored how mathematical patterns could be used to decorate the floor for the new headmaster’s office. Other emerging issues from this event were like the role of gender in the pre-

independent Kenya, and by extension, in teaching and learning of Mathematics today. The third Time Travel event was based on the historic opening of a primary school by the second president of the republic of Kenya. In this event, learners together with their teachers carried out research to try and identify mathematical concepts one can learn in a school opening ceremony. The outcome was that geometry, numbers, measurement and money were key concepts that are used in such ceremonies. The broader outcome from this event was that teachers and learners realized that Mathematics makes significant contribution in all school subjects hence the need to use the thematic integrated approach in teaching and learning of Mathematics. To illustrate: A math teacher can use the chronological years in a historical event to help learners learn writing of roman numerals like Shaurimoyo school children did during the Time Travel at their school. The science teachers can use quantity and types of food in the ceremony to teach measurement in Mathematics and nutrition in Science.

Lessons learned so far and benefits received through the Time Travel events with focus on Mathematics for Bridging Ages Western Kenya could be placed in the following categories: Social; Academic; Communal; and Economic benefits. It was through the Time Travels with a focus on Mathematics in the historic event that the idea of Bridging Ages Western Kenya and Maseno University were borne. These have become social entities that bring different groups of people together. Through these social organizations, seminars and conferences have been held. One such conference was held at Kisumu Museum and a review of the presentation modes that ranged from dance, song, dramatization, discussions to academic research presentations is highlighted in the sections that follow. This diversity catered for all those in attendance and as a result everyone left satisfied that they had learned something on how current issues and key questions can be used in Time Travels and Mathematics education.

i. The Mean Score Syndrome
The mean score syndrome has turned learners into examination robots which has led to cheating in exams and repeating class levels because of poor teaching methods. It emerged that Mathematics was the greatest culprit from this syndrome. This is because teachers of mathematics used every available lesson as drill sessions killing games and physical education sessions. As a result the presenter proposed measures like changing the curriculum to use a more holistic system of evaluation, improved methodology to be included in teacher training, informal education at home and in school to be strengthened for character development, the need to put into use the many blue prints by policy makers which have been neglected over time. He suggested that it was time to rethink the curriculum given that the current one had failed to deliver the expected results.
ii. Dysfunctional Parenthood
The presenter explained that parents have abdicated their roles as parents, as they are too busy making money and as a result destroy their families. Communication with family members is almost zero. There is minimal interaction between family members. There is incest with siblings, parents and close relatives who. Yet the types of sexuality messages communicated are indirect, incoherent and superficial in content. The messages are totally incompatible to contemporary adolescent aspirations. He concluded by saying that children require proper sexuality education both at school and at home. It was noted however that sexuality is a topic most parents in Africa do not know how to address. The Time Travel method was seen as a viable option for transmission of such messages using historic environment.

iii. Transferable Knowledge
This presentation was guided by the key question: ‘our children are going to school, but are they learning?’ The speaker gave the example of a survey that found out that nine out of one hundred class eight pupils could not do class two math. Communication, set concept, group work and IT skills were identified as transferable concepts that are not being put to use. University students have problems with these skills. It could therefore be inferred that the problem starts at lower levels of learning Mathematics. He concluded that the problem is not with curriculum reform, but in the mathematics pedagogy. It is at this pedagogic level that Mathematics in the Historic environment was then suggested as a viable methodology to counter the current inadequacies in mathematical skills acquisition.

iv. Parental Loss
The speaker started by highlighting the different development stages in learners from infancy to 18 years and the positive or negative effects of handling each stage. She ended by asking if parents are playing their role especially the fact that most parents openly admit to having had a negative attitude toward mathematics. She concluded by saying that parents should be role models including attitude towards mathematics, and should allow children to make their own career choices and that living conditions in towns were resulting in erosion of culture and values. In the discussion that followed, it was suggested that the Time Travel methodology hold the promise of teaching culture while at the same time, instilling much needed values in learners.

In the discussion that followed these presentations, it emerged that using the Time Travel method would be one option of addressing the issues raised from these presentations. For instance, instead of drilling in Mathematics, they could use learner centered and motivational activities like Math in a Time Travel to teach for understanding. The Time Travel could also be used to gap the parental loss and dysfunctional families; impart transferable concepts like culture and values in Mathematics; and it is an ideal method for dealing with the mean score syndrome in the Kenyan Education system.

The Time Travel Method—making bridges between different groups

In conclusion, using the Time Travel method to cover Mathematics in the historic environment can revolutionize many Kenya class rooms where performance in Mathematics has been quite a challenge to education fraternity. This is because the method is motivational as well as learner centered. Thus it can be used to create interest in classroom Mathematics, cause attitude change in learners from negative to positive thus giving teachers' room to cover content extensively while at the same time showing the link between classroom Mathematics and the real world outside the classroom.

Information to the learners at the school, before Time Travel event at Kisumu railway station
The method has the added benefits of bridging the gap between school and the community; bringing different members of the community together: from county Government officials to university professors and to young children in the classrooms. In Bridging Ages Western Kenya and Maseno University, Mathematics in the Historic Environment is a rich unexplored research area that could be developed further into an academic field.

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**Funkabo apartments, Kalmar 1958 – Spring feast with the tenant’s association**

*Cleaning up for the garden party*

This Time Travel event has been carried out together with teacher students at Linnaeus University in Kalmar in cooperation with Kalmar County Museum. The students were divided into groups and were able to take part in two different activities in the event. Kalmar County Museum brought a lot of props, costumes, benches, plates and cups etc. Everyone chose a new name from the year 1958.
Site and year
The site is a residential area in Kalmar, Funkabo, close to Linnaeus University. The houses are built in the late 1950s when the folkhem concept of welfare for all was in focus. The year of the Time Travel was decided to 1958, when many of the houses were built.

Objectives
- Learn and understand about life in the 1950s in Kalmar and Sweden, housing and society, compare the dreams of the good society then and now.
- Understand mathematics in the local environment and in everyday life.
- Show mathematical abilities and skills in the activities.

Facts, summary
The 1950s in Sweden was a time of change and progress. The developing of the welfare state, the idea of “the people’s home”, was in full swing. The 1950s was still a time of great social differences. The rich could afford villas and nice houses, workers moved into the new apartment blocks. The state created specific standards for the new apartments.

In Kalmar, as in so many other cities, building of new houses was intense in the 1950s and the 1960s. In Funkabo new apartments were constructed throughout the 50s. The apartments were light and modern with running water, flushing toilets, stoves, laundry rooms and garage. There were two small shopping centers, post office, bank, hair salon, bike shop, newsagents etc. The annual rent for the apartments was in 1958 about 60 SEK per m2; a worker earned 600-700 SEK per month, senior officials twice as much. The inflation was about 5% a year, the increase in salary often less. In northern Kalmar the boundary became very clear between the apartment houses in Funkabo and the villas in Berga.

The Swedish Association for Tenants was active in the postwar years and worked for more functional apartments and the rent to be kept at a reasonable level. During the 1950s, the Tenants Association worked for more child-friendly residential areas with good playgrounds and they organized recreational activities for the residents.

Scenario - Garden Party and Meeting with the Local Tenants Association
Spring is here. The local tenants’ association in Funkabo has invited the residents to a garden party, but also to discuss important issues in a formal meeting. Party and meetings often go together. People gather to prepare the party and the meeting. They want to make the area neat and clean after the winter, broom and rake and collect the garbage. Some will prepare games and competitions; others cut up cakes and mix the lemonade for the picnic.

The issues to be discussed at the meeting are about the apartments and the housing environment. What should a functional apartment look like and what is a reasonable rent, taking salaries into consideration? This year also the outdoor environment will be planned. How do we create a good environment with green spaces, a school and services? There are requests for flower beds and bushes in between the houses and of course nice play grounds for the children. It will all be planned and decided upon today. This year, the Tenant Unions in the country have a special focus on the children. Is there room for both sandpits and swings in the yard? And what can we afford? How do we make a pleasant environment for everyone, both children and adults?

Funkabo is attractive and there are often people who come to have a look at the area. They are curious about what the apartments look like and the rent. How can we furnish the apartment? The caretaker explains and presents the drawings. The residents wonder who the new persons are. Will they fit in the community?

All families are thinking about their economy. What apartment can we afford? There is also a need for clothes and food, and maybe save for a holiday in Mallorca. Some are envious on those living in the houses on the other side of the Funkabo Road. It would be nice to buy a house, but is it possible? The well-being in Funkabo has increased since the apartments were filled and new houses are still being built. It is fun with a garden party, people meet and talk. The Tenant Association expects many ideas today to pass on in the discussions and negotiations with the housing company and the municipality. How do we create a good society in Funkabo?

Key Questions
- How do we create a good living environment for everybody in Funkabo - services/ schools/green spaces? How do we design a creative playground?
- How do I want to live - in an apartment/ in a villa? What can I afford? What do I want my apartment to look like?
- How should a fair housing policy be developed? Should the wallet decide? What will happen when rent control disappears/ the housing subsidies?

Roles
Most of the participants are people living in the apartments, some are persons who are interested to move in.

The chairperson of the Local Tenant Association, The caretaker, Persons who live in a villa next to the rental houses.
Activities
1. Clean, rake, broom, whip carpets
2. Organize the tables and benches, lay the table
3. Prepare "fika", cakes, juice
4. Games – hopscotch, balls, skipping rope, dance games etc
5. Study drawings of several apartments - size, rent, economy
6. Study drawings of one apartment - furnishing, wallpaper
7. Plan the outdoor environment for the children – sandpit, swings etc and costs
8. Plan the outdoor environment for adults – flowerbeds, bushes etc and costs

How many tables are needed for everyone to have a seat?

Some issues raised in the activities were: What size of apartment is reasonable based on my income and family, when the cost is 60 SEK per m2 per year? How does inflation affect the rent and salary? How to furnish the living-room? How many rolls of wallpaper, 52 cm wide, are needed, depending on the pattern and size of the walls?

From the reflections and communications about the issues in the event, the teacher realizes the student's mathematical understanding and what content is needed to continue in the classroom. Immediately after the event there was a common evaluation including both history and mathematics.
Linnaeus University 2015/2016 – An architecture competition to change the use of the university buildings

This Time Travel event, to the present day, has taken place both indoors in mathematics educations own facilities, and outdoors in the university building’s circular courtyard, with teacher students at Linnaeus University in Kalmar. Mathematically, the focus was Geometry. Materials offered for the students were different measuring tools, rulers, measuring wheels, string and one-meter sticks, as well as drawing plans of the indoor and outdoor environment.
Objectives
- Teacher Students have a method to teach mathematics in the local environment with respect to all pupils.
- In the activities are shown mathematical abilities and skills
- Conditions are created to understand and influence changes in society

Facts, summary
Teleskolan in Kalmar was opened in 1978. It was built as a two ring-shaped building, designed by architect Sergei Mirelius. It offered specialized courses that attracted applicants from all over the world. In 2001 the school was sold to the municipal real estate company KIFAB and named Kalmar Nyckel. The restaurant and apartments were turned into a hotel and conference Brofåset. Kalmar Nyckel was leased to Kalmar University / Linnaeus University and was rebuilt after the university's needs. The university has decided to move to a seaside campus in the harbour and leave the facilities at Kalmar Nyckel. How these buildings are going to be used is not yet decided.

Scenario - Renewal plan for Kalmar Nyckel 2016
The university is finishing its business in Kalmar Nyckel and is going to move to the harbor. What will happen to Kalmar Nyckel? What are the buildings suitable for? Both officials and politicians at Kalmar Municipality and KIFAB are thinking and discussing. Brofåset will probably remain as a hotel and restaurant, but what about all the areas which the university disposes?

Kalmar Municipality has announced a competition for the renewal of Kalmar Nyckel. A selected group of building and landscape architects have been invited to come up with proposals for a section of the building. This part will be used for housing, but what is most prioritized? The needs are great; the housing shortage is evident in Kalmar Municipality. Apartments are needed for families with children and for the students, who are increasing in number year by year. Right now there is a big need for suitable housing for refugees and unaccompanied refugee children. There is also an increasing demand for homes and apartments for the elderly.

One part of the building will probably be turned into a primary school. But what about the rest? The question is what type of housing it should be used for and the design? The architects are given the task of preparing proposals for both the outdoor and indoor environment: target group, content, design? Should there be smaller extensions? Budget? The municipality hopes for many creative proposals today. An expert jury will examine the proposals. The architects must also take into account the specific outline of the building. The County Museum will do a cultural assessment of the plans.

Key Questions
- What kind of housing is most needed in Kalmar? What do we prioritize?
- How will the apartments be designed? What should the courtyard look like?

Roles
Building and landscape architects, Building and planning engineers, Museum curator

Activities
Develop a concrete plan for a particular section of Kalmar Nyckel - both indoor and outdoor environment.

Planning the outdoor environment
Some issues raised in the activities were: How much space/area does a family with three children need? Should unaccompanied refugee children live in single or double rooms? Which walls can we keep? How do we plan the best pipes in the kitchen and the bathroom? How many sofas are needed outdoors?

Kalmar Harbour 1964 – Loading a ship with rapeseed oil

The subject Mathematics can easily be left out in thematic work. At Södermåre school outside Kalmar teachers and the principal decided to work multidisciplinary, focusing on Mathematics in all subjects. This resulted in a Time Travel event for all students in grade 9 with the site Kalmar harbor in the year 1964. The students were prepared in various subjects so they were aware of the important issues to reflect on and discuss. The pupils could in the event practically apply their knowledge in areas such as measurement of volume, weight and speed. They produced their own cooking oil, which would then be filled into bottles, packaged in cardboard boxes, and finally loaded onto pallets to see how many could fit in the ship.
Objectives

- Find alternative teaching in mathematics, linked to the local environment and everyday life, as well as the relationship between mathematics and other subjects
- Reflect on the importance of the activities of a harbor and compare with other options for goods and transportation

Facts, summary

The harbour is the reason why Kalmar is located where it is. It required a deep harbor for medieval ships to load and unload. In the mid-1600s the town moved to Kvarnholmen and the harbour as well. In the mid-1800s times changed, increased industrialization and communication. Kalmar harbour needed more space. The area outside the walls was filled out and the main quay was created. Several industries started in the harbour under the management of the Jeansson family: the rice-mill, the steam-mill, the margarine factory (now the mall Barones), the oil factory and others. The handling of cargo expanded significantly and more and more cargo ships docked at the quays. The steamers transported many passengers from the wharf and the fishing vessels were kept at the Öland harbor. In the early 1900s more than 2,000 people worked in the harbour, and a lot of extra workers were needed to load and unload.

These dynamic activities in the harbor lasted until the mid-1900s. Then times changed and the activities in the harbour began gradually to decrease. The factories closed down one by one – the Kalmar steam mill in 1957, the Svea Oil factory in 1957 and finally the Margarine factory in 1964. More and more freight traffic began to use trucks instead of ships, the steamer passenger traffic ceased, the fishing declined and in 1965 even Kalmar’s first supermarket opened in the middle of the harbor. In a few decades, the activities in the harbor had substantially changed. Today the workspace has been reduced by other activities placed in the harbor and there are discussions on what will happen with the harbor in the future.

Scenario, Kalmar Harbour 1964

Work increases in Kalmar harbor in the spring. Several ships are coming in, load and unload. At this time of year a lot of extra workers are needed, even though the need has decreased in recent years. Sydfart is one of the cargo ships that have Kalmar as its home port, and she goes along the coast with various kind of cargo. It’s an old ship and it cannot take the largest loads, but sometimes work is intense.

Today, a number of young people are called in to help with the handling of goods in the harbor, above all at Sydfart, but also to assist with the paperwork at the broker’s office. There is also another motive to this. The port is threatened, for the first time in the history of Kalmar. It is important that young people get an insight into the work at the port for a better understanding. The last industries in the harbor are closing down, the oil mill and the margarine factory. The staff is laid off, but still help with the production of oil is needed.

It is obvious for all that Kalmar port is changing, as are several other ports in the country. For decades and centuries, the port of Kalmar has expanded and been relocated to meet the needs of cargo and trade. Industries have been placed in the harbor for easy transportation. But now the industries close down, the goods decrease and even a supermarket in the middle of the harbor is going to open.

Those who work in the harbor are concerned, what’s the next step? Apartments, beaches...? Freight traffic is steadily increasing on the roads, the trucks are taking over. Are roads and railways the future? Car traffic increases as well as the car ferries to Öland; The main quay is full of cars. But now there is talk of a bridge to Öland. Who will then go by ferry?

Young people arrive in the morning for the day’s work. They will help to calculate and load Sydfart for one of the final tours with goods from the oil factory. Will there be a need for this many extra workers in the future? What is the future of the harbor in Kalmar?

Roles

The students are young people who are called in for temporary work in the harbor.

The adults are foreman and supervisors at the broker’s office, the handling of goods at Sydfart and the oil factory, the title corresponding to the task and responsibility. There are guests from the newly independent country, Kenya (independent in 1963) and the large port in Mombasa (formerly part of Zanzibar)

Key Questions

- What value has the port of Kalmar? How is the future?
- What activities should there be in the harbor area? What is most important? Handling of goods, trade, cargo ships, passenger ships, supermarkets, factories, apartments, beaches...?
- Ships, trains or trucks for transport of cargo? How is the future to be? What is best economically, for the environment?
Activities

- Production of cooking oil - weight, volume, quantity
- Load a container - volume, weight, number of goods, costs
- Broker's Office - goods, services, economy
- Sydfart - load volume, speed, fuel
- Make a meal - amount, number

What density has the rapeseed? What is the weight of one liter of rapeseed oil? How many kg rapeseeds will you use to fill up a half-liter bottle of rapeseed oil?

How many m³ can get into the ship's cargo space?

How many meatballs are needed?
Kenyatta University Primary School
1970 – School inspection

This Time Travel was made in collaboration between lecturers and teacher students at Kenyatta University, teachers and learners at Kenyatta University Primary School, Linnaeus University and Kalmar County Museum.

We decided to have 20 girls and 20 boys from class 7 for the Time Travel event. The learners were excited as they gathered. The boys got a blue scarf and the girls a red scarf to identify themselves as students in 1970.

Objectives
- Teachers have methods of teaching mathematics in the historic environment
- Pupils have an understanding how school mathematics can be used in the historic environment.
- Pupils realize the benefit of basic knowledge in numbers and measurement

Facts, summary
In 1965 Kenyatta College in Nairobi opened, two years after independence. In 1978 the Faculty of Education of University of Nairobi was transferred to KUC and KUC became the leading institution for teacher education in the country. New houses were built on campus and the staff grew extensively. Most of the increasing staff stayed on campus with their families. There was a need for a primary school and in 1978 Kenyatta University College Primary School opened as a school for the children of the staff at KUC. In August 1985 the University College was changed into a full university. From the beginning the school was quite small with small classes. There was a desire to have a high quality education.
Every school was inspected now and then from the national educational authorities. The school inspectors checked if the education was on an adequate level, the books in order and that the curriculum was followed. The schools seldom knew when the inspector(s) was/were coming.

**Scenario, School inspection in 1970**

KU Primary School opened only two years ago and has big ambitions to be a school of excellence and promote quality education in a child friendly environment. Today there is a rumor that the school is going to be inspected by national and/ or local inspectors. The inspectors seldom give notice in advance, so nobody really knows if they are coming today or another day. And will it be inspection of the whole school or in just one or two subjects? Will there be one inspector or a panel? When they come the inspectors want to check the documents and observe lessons. They can ask questions in the classroom, to understand the teaching situation. They often interview both teachers and pupils to get a full picture of the school. Before they leave, at the end of the day, they will give an oral report and summarize their experiences. A few weeks later the written report will reach the school. A school inspection is quite nervous for the teachers and the head of the school. What will they say? This is decisive for the future of the school.

The teachers have lessons as always but of course they are well prepared. They want to do a good impression if there will be an inspection. One of the classes is outside to have a lesson in the school yard in Mathematics, more specific on measurements. This is an alternative way of teaching compared to the classroom. Probably the inspector is quite curious in this way of teaching. Will he/ she find it a good way of teaching and learning?

The teachers start the lesson as planned and the pupils are divided into different activities. Nobody knows if there will be an inspection or not. It is best to be prepared.

**Roles**

The pupils are the pupils, grade seven, in 1980. The adults are teachers, teacher students and assistants at the school in 1980. School inspector. Lecturers at the teacher college.

**Key Questions**

- How and when do I learn best? Understanding, quality of education (listening, reading, doing, problem solving; in the classroom, outside; at school, at home; relevant themes, motivation, etc.)
- In what way is this learning relevant for me? When can I use it?

**Problem-solving activities**

1. The school is new. We need a wire around the school yard to make the school safe.
2. How much water is needed every day for all pupils in school? (500 pupils)
3. What length of rope is needed to tie between two trees with the distance of five meter?
4. How can you show the relationship between different numbers which you meet in your daily life? What can the different numbers represent in your life?
5. You are going to plant beans on the school yard. You have material for a 20 meter fence to protect your plants from animals. How will you plant? Distance between the plants? Plant the beans. How many beans did you plant?

*How much wire do we need? What will it cost?*

*Estimation and calculation of water needed every day at the school*
When fencing the school, students needed to work with numbers and expenditure that makes sense to what they learn theoretically in the classroom. Students asked questions like: what fencing material is needed, will we need posts, how many posts will be required, what is the perimeter, how much will the material cost depending on the distance between the posts? Learners needed to calculate the perimeter and use equipment from the time period and estimate costs based on the currency of the time. Learners learnt to understand the need to estimate and reflect on how the same problem could be solved today.

I have six siblings and I am 10 years old. The numbers need to be put in the correct relationship to each other

Kisumu Railway Station 1972 – Preparing the opening of the new train station

The railroad track is cleaned

This Time Travel event in Kisumu in western Kenya was done in close cooperation between Maseno University, schools in Kisumu, the National Museums of Kenya/ Kisumu museum, Linneaus University and Kalmar County Museum. Lecturers at Maseno University have seen the need to strengthen the teachers also in the lower grades, though they are not trained at the universities, in order to get a positive attitude and deepen students’
understanding of Mathematics. After several training days about the Time Travel method and the history of Kisumu, the participants agreed to undertake a Time Travel event at the railway station with a primary school, 25 girls and 25 boys from grade 5. This Time Travel event was followed by more. Teachers from several schools have participated in these events at Kisumu railway station.

Objectives

- Discover how Mathematics can be used in the Historic Environment
- Learn local history of Kisumu and the connection to today's society
- Connect university, museum and schools in Kisumu municipality

Facts, summary

Kisumu town was founded in 1901 as the end terminal of the Uganda Railway. In December that year the railway line reached Lake Victoria and in February 1902 it opened for goods and passenger trains. The Uganda railway was a huge logistical achievement and became strategically and economically vital for both Uganda and Kenya. Construction was carried out principally by laborers from India. The Uganda Railway also developed shipping services on Lake Victoria, passenger and trade steamers.

By the 1930s and 40s, Kisumu had become a leading East African centre for administration, transport and commerce. After independence in 1963 Kisumu developed even more as a centre for trade and communication. The 1960s and 1970s were times of growth and prosperity. A new railway station opened in 1972, the same year as the municipal boundaries were widely extended. The incorporation of new residential areas faced challenges in terms of social service. In the 60s the harbour was improved and a new train ferry service across Lake Victoria was opened. A lot of cargo was transported on the lake.

The airport in Kisumu was built already in 1931 and served for many years as an international hub.

Kisumu has always been a segregated town, since it was first outlined in 1903, with clear demarcation of African, Indian and European areas. The progress of the town stagnated in the end of the 1970s. In 2012 the passenger trains operating between Nairobi and Kisumu stopped. Kisumu is today a fast growing town facing challenges and opportunities in services, housing, business and transport.

Scenario, Preparing for the opening of the new railway station in 1972

The new train station is almost finished after years of planning and took more than a year to build. The old station is too small and can't facilitate the growing amount of goods and passengers. Kisumu is a thriving town, a town of communication. Business and trade are prosperous, there are always people coming and going. The harbour has been improved, there are new and faster ferry services across Lake Victoria. The airport is growing with both domestic and international flights to several cities on the continent. The railway has always been the centre in Kisumu and it's going better than ever. Passengers and goods are increasing. The railway and harbour company is famous for its professionalism and also for the design and construction of equipment for trains, stations and ships. Kisumu town has this year incorporated new residential areas and the administrators are making plans to improve the service and living conditions, both in the new and old areas. Of course there are many challenges in a fast growing town like Kisumu.

The day is finally here when the first train from Nairobi will arrive at the new train station. All the work has been focused on finishing the carpentry and painting on the new building and there has not been time enough to prepare for opening ceremonies. Therefore East African Railways and Harbours Corporation have called for extra workers today, young and old, to finalize the last operations. The platform and the rail have to be cleaned and there is always goods to reload. There has to be a celebration sign, nice decorations on the posts and the new timetable is not totally finished. And of course there has to be some singing and dancing when the first train arrive, and that train is expected already this afternoon.

Key Questions

- What is the best way of communication/transportation — cars, trains, ships, airplanes? For me, for the community, for the environment?
- Can trains and ships be a mean of developing the region, the country, East Africa?
- How do we improve communication between different groups of people in Kisumu and how can we improve living conditions in this fast growing town?

Roles

Station master, ticket master, inspector, foreman, officers, vendors, clerks, labourers. The students are young persons who have been called in to prepare for the opening of the new train station (some Indians and most Africans).

Activities

- Make a celebration sign for the opening of the new railway station: text, illustrations. Make (paper) garlands to decorate the station.
- Finalize the train timetable, interpret timetables, price for tickets to various places 1st, 2nd, 3rd class, weighing of parcels.
- Make boxes and containers for the vendors
- Clean the platform and the rail
Maseno School 1928 – Welcoming of the new headmaster

Maseno University is hosting a yearly Maths Camp organized by the Kenyan NGO African Mathematics Initiative (AMI). The Maths Camps give students between 12 and 19 years an opportunity to learn mathematics in a different way, inspiring them to develop a positive attitude to the subject. The cooperation between Maseno University, Linnæus University, Kisumu Museum and Kalmar County Museum made it possible to integrate a Time Travel event in the Maths Camp activities.

Objectives
- Introduce the Time Travel method as a way of teaching and learning Mathematics and History
- Discover Mathematics in the local environment and in everyday life, show mathematic abilities and skills

The candies are divided into boxes, twice as many into the large as into the small

All learners were given some paper made money, a larger amount for those who were Indians (they also got a headwear). The learners could use the money to buy train tickets (1st, 2nd, 3rd class), to any destination, buy candy or biscuits in the store, or save them. The mathematics that was needed to solve the problems of the activities was taken from the curriculum, grade 5.

How much does it cost for the parcels to Mombasa?

Initiation ceremony for the Time Travel event
Facts, summary
Maseno School is the oldest formal school in Kenya. It was established in 1906 by the Missionaries of the Church Missionary Society of the Anglican Church. Soon the school attracted boys from all over western Kenya. Besides reading and writing, students were taught various skills such as carpentry, tailoring, printing and building. Teacher training was introduced in 1920. Maseno School sits on the equator and has its position on both the southern hemisphere and the northern hemisphere.

Edward Carey Francis, born in UK 1897, came to Kenya in December 1927 and became headmaster of Maseno School in January 1928. Carey Francis had studied and graduated in Cambridge. His main field was Mathematics and Analysis. His revolutionary ideas in education changed Maseno School completely. Under his leadership the school became one of the best schools in East Africa. He took mathematics education to a completely new level. Carey Francis was a colonialist, a patriarchal man with deep moral, called "Achuma", the man of steel.

Scenario, Welcoming of the new headmaster of Maseno School 1928
There is a new headmaster of Maseno School appointed and he is going to be welcomed in a proper way. The staff and the students have heard about Edward Carey Francis, but they do not know much. They know that Mr Carey Francis is from England and arrived in Kenya just before Christmas. They understand that he has a focus on Mathematics and has many ideas of developing education at the school. But they have also heard that he does not have any high thoughts on what Kenyans can achieve and what skills they need. The students want to prove otherwise, that they have mathematical and scientific skills, even the girls. Girls are not allowed into the education system. Is that fair? Don't they need the skills as well?

There is so much to do for the welcoming. The school has involved the whole village. Students, teachers and villagers work together. The area needs to be cleaned, the dancing and music prepared. And the new headmaster has to have a new office. The idea is to construct the office building just on the equator. Is that possible, how do we find the equator? Also the classrooms have to be refurbished with new floors in various patterns.

Everyone is very busy, the students of the school, the teachers and the villagers. Mr Carey Francis can arrive at any time. While preparing and working, people talk about the new kind of education that Mr Carey Francis will bring to Maseno School. What is the best way of learning? For me? For the country? How can we convince him that Kenyans are capable of solving complex mathematical and scientific tasks? The villagers are keen to show the local culture by presenting Luo and Luhysa dances and drum rhythms. Everybody wants to impress Carey Francys.

Roles
The boys are students of the Maseno School, the girls are from the village, all helping in the preparations. The adults are either teachers from the school, villagers or missionaries.

Characters that provide clues for solving logical challenges: a local shop owner, a salesman, carpenter, farmer, tailor, explorers, a witch doctor and the local chief.

Edward Carey Francis

Key Questions
- How is the education at the school going to be developed and improved, relevant for me and for the country? For boys and for girls?
- How to demonstrate mathematical skills and knowledge?

Activity challenges
1. How to find the equator? We want to build Edward Carey Francis’ office as close to the Equator as possible. This will impress him because he is a mathematician. You may ask people in the village for help. Your task is to carry out an experiment, suggested by someone in the village, which will help to find the Equator. You must then find out the mathematics and physics behind the experiment and present this to Edward Carey Francis at the welcoming ceremony. You may ask the farmer, the witch doctor, the chief, the tailor, the explorer or anybody for help.

(The farmer suggests that the Equator crosses his own land, because it is the largest flat area in the village; in fact, he wants to sell the land to get money. The Witch doctor does not know what the Equator means, but is unwilling to admit this as he would lose his reputation in the village. He asks what ‘Equator’ means and once the students explain the meaning of the word he claims that the Equator line corresponds to the hills surrounding the village, he has never travelled beyond the hills and claims that beyond the hills is the other side of the hemisphere. The Tailor doesn't know how to help finding the Equator, but tries to sell string. The students should then go back to buy string from the tailor and use it to build their own pendulum. The Traveler/Explorer is a very educated person from Asia, he has a book on the experiment and tells to the students that in order to find the Equator they have to build their own pendulum; once they have done so, they will go back to him and he will explain to them how to use it.)
2. How should the classroom floors be designed using geometric patterns? Edward Carey Francis likes symmetry and particularly rotational symmetry. Therefore the task is to produce a tiling pattern for his new office floor that contains some rotational symmetry. You will then present your tiling pattern to Edward Carey Francis at the welcome ceremony for him to judge. You may ask people in the village, for example the tailors, if they have any interesting patterns which could inspire your own tiling.

3. How to write down complex drumming rhythms? To welcome Edward Carey Francis at his arrival in Maseno, we want to show him the cultural diversity of this region. Kikuyu, Luo and Luhya are especially famous for their drumming traditions, but since Maseno was a Luo/Luhya region at this time, we want to present some Luo and Luhya drum rhythms to Carey Francis on his arrival. But how can we communicate these rhythms to him, as he doesn't know how to play drums? To impress him, we want to write them down in a mathematical language. In Maseno, there are four people that know one rhythm each very well. But we don't know who these people are. If they have taught the rhythm to one group, they will not teach it to the other one after that. Each group goes around trying to find local musicians to teach them a drum rhythm. Once a group knows how to play a rhythm, they try to write it down using musical notation. Prepare a musical welcome for Edward Carey Francis with drumming, dancing and singing. Discussion about the relation of Mathematics and Music.

Friendship and Partnership on the Time Travel method

Linnéa Danielsson

The Time Travel method at Torslunda School, Sweden
Torslunda School is a primary school located in Mörlvånga municipality on the island of Öland, Kalmar County, Sweden. The school has for many years used the Time Travel method as part of education in almost all grades. Time Travels actualize and make history alive and ignite the pupils’ interest in a practical, creative and exciting way. The five and six year old children in the preschool class participate in a Time Travel event to the turn of the century
1900, using the old buildings and beautiful garden of the Local Heritage Society next to the school. Grade three goes on a field trip to Eketorp Fort on southern Öland for a Time Travel event to the Iron Age, 425 AD, and grade five takes part in a medieval Time Travel event, 1397, at Borgholm Castle. The pupils of grade four and five also make a Time Travel event together with the Local Heritage Society to the end of the 19th century in the village of Kalkstad not far from the school, to experience the hardships on Öland at that time and the extensive emigration to America.

The Time Travel events are made in cooperation with Kalmar County Museum. Museum professionals’ work together with teachers and other staff of the school to plan, execute and evaluate the educational outcome of the Time Travels. The teachers prepare the pupils in several subjects and make a follow up in school after the event. Everything is done in line with the curriculum. Evaluations clearly show that this is a good way of fulfilling the requirements in various subjects.

Torslunda school is part of the network “Mathematics in the historic environment”, initiated by mathematic educators at the teacher training program at Linnaeus University in Kalmar together with Kalmar county museum. Mathematics is an important subject in several Time Travel events as it provides unique opportunities to visualize Mathematics in a concrete and practical way.

**International perspective**

According to the Curriculum for the compulsory school, preschool class and recreation centre in 2011, all education shall include certain general perspectives such as a historical perspective, an environmental perspective, an international perspective and an ethical perspective. The curriculum reads as follows: “It is important to have an international perspective, to be able to understand one’s own reality in a global context and to create international solidarity, as well as to prepare for a society with close contacts across cultural and national borders. Having an international perspective also involves developing an understanding of cultural diversity within the country” (Lgr11, s. 9 – 10). Torslunda School has for many years had the ambition to establish contacts with other schools in the country as well as abroad. To exchange experiences with educators from other cultures and school systems is very enriching and developing.

Through Linnaeus University, Torslunda School made contact with Shaurimoyo School in Kisumu, Kenya, that was interested in partnering with a Swedish school that used the Time Travel method. A funding application for exchange of teachers was sent to the Atlas program at the Swedish Council for Higher Education, and also approved. In February 2016, the headmaster and three teachers from Torslunda traveled to Shaurimoyo Secondary School in Kisumu and in April, Torslunda School welcomed a group of teachers from Kenya.

![Cooperation with Shaurimoyo Primary School, Kenya - Time Travel in Kalkstad](image)

The visits included classroom participation, educational seminars and pedagogical discussions, meetings with school politicians and of course Time Travel events with pupils, teachers and local community. The pupils from the schools exchanged letters. We learnt about each other’s school systems, teaching methods, conditions for the teaching profession and training as well as the influence, responsibilities, and participation of the pupils. We chose to prioritize Time Travel and Mathematics, as both schools wish to develop this method. We agreed that planning and follow-up are very important for Time Travels. Torslunda School engaged in a lot of preparatory work for the Time Travel events to assure that the pupils were well prepared for the event. Furthermore, thorough evaluations and follow-up lessons are just as important as the event itself in order to visualize and deepen the pupils’ learning and understanding.

**Similarities and differences**

Staff and pupils at Torslunda School and Shaurimoyo School have in several ways enriched and achieved an understanding for each other’s conditions. There are many similarities but also big differences between our schools, cultures and living conditions. There are clear economical differences, and the availability of learning materials and equipment is far greater in the Swedish
schools. The number of students in each class is higher in the Kenyan school. Most of the discussions between the headmasters and politicians were focused on health and safety for the pupils. Student influence and contact with parents is very important in Sweden. Resources and teaching material differ considerably between the Swedish and Kenyan schools but the commitment and competence of the teachers are the same in both countries. Headmasters and teachers have different conditions but are driven by the same goal and interest for high quality education, a safe environment and academic success of the pupils. The similarities are clear when it comes to interest for development of education, follow current pedagogical research on learning, which is the very foundation of our profession. The exchange visits have created solidarity and a better understanding for cultural diversity.

Way forward
Our goal is to develop a long term cooperation, making Shaurimoyo School and Torslundas School partner schools. There is a clear vision where more teachers and school staff will be given the opportunity to visit our respective schools in order to develop an understanding for each other’s culture and education. By letter exchanges between pupils, cooperation between teachers and visits to each other’s schools, we want to learn from each other. The ambition is to establish a partnership that contributes to increased competence and experiences as well as an interest for global and international issues.

Learning Mathematics in the Historic Environment – Shaurimoyo School

Benedetta Imbaya, Rosemary Oromo and John Ouma

We learn from each other across the countries, at Shaurimoyo Primary School

References
Curriculum for the compulsory school, preschool class and recreation centre in 2011. www.skolverket.se
www.utbyten.se

Personnel at Shaurimoyo Primary School
In order to enhance teaching and learning of Mathematics, a teacher must make use of effective teaching and learning strategies. Good teaching is a matter of personal aptitude and attitude which requires thorough planning and selection of approaches and methods that will result in offensive learning of knowledge and skills in Mathematics. History and application of life develops a positive attitude towards learning Mathematics. It enables the development of a capacity for critical thinking, reasoning and discovering skills in solving problems in any situation, and restructuring of the ideas into useful and useable ways related to what is learnt and the world in which they are living.

Some of the difficulties, challenges and problems that arise in Mathematics may be associated with various issues in life like: reading difficulties, disabilities, gender, culture, special needs, nature, structure, texts, curriculum of Mathematics, Methodology or Pedagogy, systems of education especially for Mathematics and lastly the environment in which an individual lives. Classroom environment should be one which is void of any verbal or psychological harassment for high level performance to be realized. It is important to examine all factors that interfere directly or indirectly with teaching or learning.

Nature of Mathematics
Not only is the nature of Mathematic questioned. Ernest (2004) debates the existence of two opposing philosophies of Mathematics; on hand is the traditional or the absolutist view of Mathematics which maintains that mathematical knowledge is made up of absolute truths and represents a sphere of certain knowledge. The truths once established by cold reasons alone stands forever within the domain of human consciousness. Indeed the claim is that they were true before humans came to be and will remain so after our departure. The absolutist school goes on to argue that mathematical truths are thus timeless, value free and culture free. Such the view has over the years given the grounds for mathematics to be viewed as cold, abstract, ultra-rational, difficult and more importantly by association with other ideas and values in life. A general view of mathematics in the society is still embedded with the culture which has made the enormity of the problem become apparent. There is even a fallibilist view of Mathematics that claim that Mathematics is fallible, laden with values and culture of the society that create it and as such should never be regarded beyond revision or correction. The fallibilist view of Mathematics does not reject the idea of the structure within Mathematics, rather it suggest a realism of multiple overlapping and evolving structures that can grow and develop, be modified, refined and redefined over time, a view that is encompassing warmth and humanistic traits. A view that admits to a process of investigation, blind alleys, restarts, mistakes, frustrations, confusions, failures and successes. According to Locke,

Mathematics is a way to settle in the mind a habit of reasoning. Characteristics from these are simplicity, similarity, certainty, originality, verification and concentration.

In the present world it seems impossible without having a basic knowledge of Mathematics. Truly speaking the ignorance of Mathematics from the masses is a formidable obstacle in the way of any form of progress and development. Talking about Mathematics Napoleon said “the progress and improvement of mathematics will continue to occupy a prominent place in a man’s life in terms of major and minor activities and as well creating a system and solving problems. Mathematics is a powerful tool, a mirror of our civilization. Inventions originate from Mathematics; all fields of life are dependent on Mathematics.

Mathematics teaching
Stereotypical styles and texts of writing that feature Mathematics as difficult, challenging, impossible or having its particular people given to it. This has led to teasing, feeling of being subordinate to the subject or others around you, only asking for assistance through solving a problem. As we work on Mathematics, let us make learning it easier and more fun by looking for these suggestions.

- Working with a group of the classmates on activities that helps become a good problem solver.
- Ponder on the purpose; rationale to find answers in all the ways Mathematics is used every day at school, home and everywhere else.
- Knowing the meaning of mathematical words helps in solving problems and understanding directions in the books, tests and life.
- Have something always to remind you of what has already been learnt that will help in the new lesson and also in future.
- Use of concrete resources and examples to clarify explanations to establish mathematics concept. Helps to keep mathematics skills sharp.
- Make the learning of Mathematics fun and challenging. Use relevant games, poems, songs, drama to enlist and maintain the learners’ interest.
- Computer and calculator activities
- Link to other subjects/disciplines like science, social studies, history, language, arts, health physical education and others.

Mathematics is used in all cultures. Teaching and learning materials and resources are culturally appropriate. Techniques are adapted and refined by the culture on ground. A fruitful approach of teaching and learning of Mathematics based on historical environment is the Time Travel method. This is a concept to teach and learn in a given discipline like mathematics, history,
languages, life skills and all rounds. It is a discovery, problem-solving, interactive, dramatic and very practical method of education. And it’s a child and community centre method where all are involved, an in-depth way of learning that will never be forgotten.

**Discussion about emigration in a Time Travel back to 1893, Kalkstad Sweden**

**Reflections from the partnership**

- The exchange visits formed good exposure grounds to the teachers in handling various issues affecting the learners, hence leads to their holistic development.
- The partnership formed the best platform for educational, cultural and heritage exchange to the teachers.
- Good attributes in the education curriculums in both countries can easily be implemented to boost the teaching of various subjects. The use of the Time Travel method in the teaching of mathematics and other subjects is a great milestone in the education sector.
- The practical teaching and learning can easily transform the teaching arena to become more realistic and holistic in nature to the learners. This promotes their self-esteem and they will be eager to learn more.

**Reference**

Mathematics is a problem for many learners and a challenge for several teachers. This book discusses an innovative approach to mathematics education, which have been positively received by both students and mathematics teachers. The book presents the methods and exercises of mathematics, which have developed in educational approaches, the focus of which is to investigate historical, cultural, and social contexts and historical characters. This is the question that can be asked: How can we create a meaningful and motivating environment for mathematics? Where can we promote a deeper understanding of mathematics and make the students realize that mathematics and mathematics education can provide a better understanding of human activities? The question of mathematics education is a problem for many learners and a challenge for several teachers.