THE SWEDISH - NORDIC - KNOWLEDGE TRAIN

The purpose and aims

- Bring together universities, research institutes and science centres in the Nordic countries, offering a joint platform for cooperation, consultation and dialogue across boundaries and disciplines.

During the Swedish Knowledge Train a crucial cooperation between the Mid Sweden University and Technichus has evolved. In many levels science center pedagogical methods in teaching science to teachers and pupils has changed the way of teaching science in the teacher's program at the university. Influenced by the STEAM (Science, Technology, Engineering, Arts and Mathematics) the university set a profile on the teacher's educational program where arts and esthetical expressions has been in focus. This step has been taken to visualize the, sometimes, abstract theories of science. Dancing as well as music and drama has alternately been a part of the science teaching.

The cooperation with the Biophilia project in Sweden has not been successful at all. There have been lots of changes in project leading from the owner of that project which has affected the cooperation.

Technichus had a late start of the train tour and therefor contracted a dancer and two graffiti artist. These artists use a digital graffiti tool called Tag Tool and together with the dancer they toured on behalf of the Knowledge Train with a digital lightning and dancing science show called Orbit.

During our Swedish Knowledge Train we taught science and dancing in an adventure called "Zink – a science adventure".

The autumn 2015 in Sweden, was as well as so many other countries affected by the war in Syria and thousands of refugees coming to our country. Our little town consisting of 25 000 citizens got more than 1 200 refugees, mostly from Arabic speaking countries. We took a chance of inviting these people to Technichus, to learn about infrastructural science such as recycling, water supply, waste etc.

Two of the refugees joined us on the tour in January and February to act as translators while we visited small communities in our region. All of these small communities had suddenly almost doubled their amount of pupils due to the immigration. They had problems with communication since translators in Sweden are two few for this amount of refugees coming. Having two Arabic speaking persons with us on the tour was successful for meeting all these new children.

- Spark interest and self-confidence in children and teenagers for learning and discovering.

Due to the refugee situation – again – the two Arabic teachers/explainers on the tour acted as role models to the newly arrived children and their parents. Although our two co-workers arrived to Sweden as late as September 2015, they could act as a bridge between refugees and Swedish pupils/persons. That confidence was probably the most visible effect we could see on the tour.

In our region the interest in science subjects as well as mathematics does not increase. When pupils choose their program for gymnasium (Gymnasiet) they rather choose social, esthetic or language based programs. To increase the number of pupils choosing science and mathematics we need to reach out to the younger ones to plant a seed for the future. We need to make sure that they have enough self-confidence to continue being curious about these subjects. On the tour we could see that the teachers in lower ages doesn't have enough education themselves to inspire the pupils. The teachers are afraid of trying new things because their role has traditionally been "I know more than you know and I will teach you what I know"-way. All the new technology wich causes information to be available everywhere sets new expectations on the teachers. They have to learn side by side with the pupils.

The tour we made was therefor set up to co-learn with the pupils. They could be the one who explained and visualized while experimenting. This is a model to increase self-confidence in pupils.

Another way which we also used is on a play level. In play there is no right or wrong. Therefore, you can always succeed. We always try to build our pedagogical programs in a way that leads to success instead of failure. The pupils set their own goals and expectations on for example programming with Bee Bots or dancing with Zink.

The purpose of the "What does the body do?"-show is to get the children to understand and love their own bodies – the most important tool they have in life. They learn about the body mechanics, the vascular system, joints and brain when it comes to balance and rhythm while dancing. Having self-confidence in your own body is very important for you over all confidence.

- Encourage curiosity and excitement about science, engineering, technology and mathematics.

The generations growing up today are more "button-pressers" than the understand what happens when they push buttons, or swipe screens. A lot of science is magic for them and to encourage them we let them create moving things, things that makes noise or in other way perform something. The look in a child's eye when they realize that they have abilities to create something useful is priceless, but hard to measure.

The science center pedagogical method always uses the spectators to be interactive more than only watching. As soon as they are a part of the show or the creativity they engage to learn.

The method used are often presentation of a problem and useful tools, but not the answers how to solve the problem. In the process of solving the problem we use technical language to teach them words used in science.

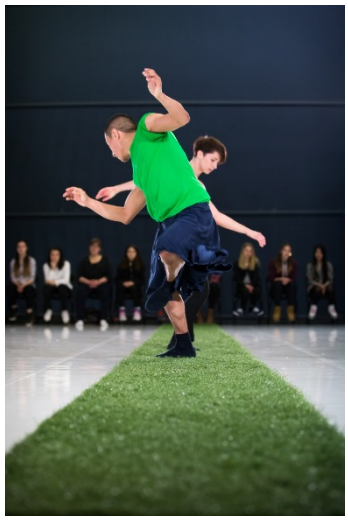
All exhibitions in our science center our playful and encouraging. This idea was implemented in the tour by using toys and other fun stuff to make the children want to interact by playing, and without knowing that they were learning as well.

At every community we visited, we also invited the society and parents for evening workshops. When we had the evening workshop AFTER the school activity we could see that the pupils took the roles of being tutors to their family members in a very pedagogical way. This is something we really will use in the future touring events.

- Connect natural sciences, technique, art and innovation between different school stages, institutes and industry.

All of the shows and programs that we have had on the tour has been adjusted to the different age groups. In our daily job on the science center we can see that the sooner the children meet science, the more it effects their future choices of education. It is hard though, to present this idea to schools that wants to “do as they have always done”. We could see that we had better results when it comes to the participants’ joy and interest when we presented something not expected to them, such as programming toys for small children for the older ones. Or chemistry for the younger ones.

Dancing has been our main focus when it comes to arts integrated in STEAM. Since many other countries chose music and singing, and since our region is very famous for our dancing ensembles that was the best choice for us. All this time we have been talking to not only the dancer connected to our project (Elin Kristoffersson) but also with the nordic dance ensemble Norrdans. They had planned to join the project but instead used the inspiration from the STEAM-ideas and their choreographer created the dancing art work Black Forest, which is now touring (http://norrdans.se/forestallningar/aktuella-forestallningar/). Despite the fact that there was no actual cooperation between us we are proud of the outcome.



The Mid Sweden University has struggled with moving campus from Härnösand to Sundsvall the last year. They are also struggling with too few applying to the programs. They have used the idea of the project to profile the teachers program, especially the science part. In every science course they now integrates esthetics, cultural and art forms.

- Encourage new methods in formal and informal education.

Since we as a science center already uses new methods we are using this project to encourage teachers and teacher students to break traditional educational methods and create new.

Thanks to that work we during this project realized that by altering the environment and the tools for teaching we can change teacher’s educational method. That has resulted in two different research projects where Mid Sweden University and Technichus is involved. In one of those projects we applied a Bazaar Environment in a public school and the different teachers are supposed to use that environment as inspiration for multi-disciplinary teaching.

All of our staff was told – during the tour - to also document what the ordinary teachers chose to do while we were busy with the children. Surprisingly many chose to go away from the group, not participate at all when their teaching role was gone. They did not chose to be one of the learners either. Without having any evidence that could be a way of showing that the hierarchy in the classroom still is important for the teachers. To ensure new methods of learning and teaching the teachers therefor have to make the change and get the right tools to make that change.

- Combine educational value and entertainment for all age groups by using interactive and dynamic pedagogical approaches.

In most of the programs this is the purpose. Joy and learning is a perfect combination.

It was easier though, in the artistic workshops (magic, dance, light graffiti, science show) than in the more traditional ones. On the tour we sometimes used classrooms for the shows, and as soon as pupils enter a classroom were a teacher figure stands at the desk, the

classroom teaching is the role model. The expectations will then be ordinary classroom teaching. To break this pattern requires a lot from the leader of the show/workshop.

- Offer opportunities to present local businesses, innovation and knowledge companies, thus provide insights for young people into the opportunities offered by education, and how it can be harnessed locally in the future.

We have started this work but only just began. We've had meetings with the Regional Industrial Association Group. The members are companies mostly in the technology or forest sectors. They showed a lot more interest in participating with us due to the Knowledge Train tour we performed.

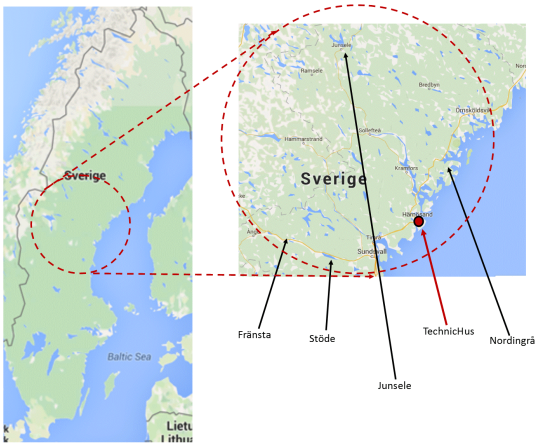
The geographical distance between higher education, science center and the small periphery communities and their companies is a problem that partly can be solved by offering touring operations in a larger scale. If the local companies can see that their children get benefit from the company cooperating with an educational partner – such as a science center – the interest in those kinds of agreements will increase.

Unfortunately, we cannot show any results of that work yet.

- Providing opportunities for reaching remote areas, or hard to reach communities, that seldom have access to events of this type, opening up new possibilities of social inclusion.

As a science center we looked back at our statistics and could point out ten different communities that never or very seldom visits us.

We contacted the local libraries for cooperation regarding facilities and recommendations. After that dialogue we chose four communities to visit, shown on the map below.



All of these communities could offer accommodation for the train staff which was crucial to our planning.

To all of these communities we sent post cards for the children in school to bring home. We invited families and friends and the public through local Facebook networks as well as posters on local places

The posters were designed to be understandable with help of images instead of text to attract the

Aims and contribution

The main participant in the Nordic Knowledge Train Sweden is Technichus Science Center. Thanks to the project Technichus got a new start with Mid Sweden University and the dance institutions of our region. The project has resulted in better relationship between the science center and the university and the periphery parts of our region. After the tour some of the schools have begun asking questions about how to continue the work we started at the tour. That is very hopeful for our plans for the future.

The relationship between the Swedish Biophilia project and the Swedish Knowledge Train has not been as successful as we hoped. Unfortunately, the Biophilia project leader was changed two or three times which effected the cooperation. The information had not spread correctly from person to person and that made it hard to start all over again two times. At last the schools visited us anyway and we had some pedagogical programs in science center environment for them to participate in.

Activities

Some costs of the project money have financed to the ***project meeting activities***, twice in Copenhagen and Helsinki.

In order to get Mid Sweden University involved in the project we made a study travel to the ***Faroe Islands*** at their premier activity. The representative for Mid Sweden University paid for his own expenses.

Before the project started we sent two ensembles out on some tasks to begin the touring sooner. The first half of 2015 these events where:

Hur gör kroppen?/What does the body do?

A dance and anatomy interactive performance act touring to periphery parts of our region.

In Hälledal and Brunne on 29th of January 2015, interacting with 42 pupils.

In Kramfors on 12th of May, interacting with 23 pupils.

Orbit on tour

In the spring av 2015 we sent our dancer and her ensemble on a dance and digital graffiti tour in the north of Sweden, to small communities like Älvsbyn and Kramfors. The program described above.

They spent two weeks (no 12-13) in Älvsbyn meeting 566 pupils in the ages of 10-12 years old.

In Kramfors they spent one day, the 4th of March 2015, meeting 90 pupils in 3 different workshops.

In the summer of 2015 we made our first arts and science event on Technichus. That event were the Magic and Reading event.

Magic and reading

Our Swedish childrens book character Alfons Åberg has been in focus and therefore Technichus has used reading and using collage techniques to visualize science. Science is in many ways used in macig tricks and we invited a magician to perform together with a pedagogue from Technichus teaching physics and illusions/optical illusions.

This event occurred on August 6th to celebrate Alfons Åbergs birthday. More than 300 people visited the shows.

The Swedish Knowledge Train (21/1, 25-26/1, 28/1, 1-2/2 2016)

We travelled around in the region to the communities that seldom visits Technichus due to transport problems. The communities we choose were Fränsta, Junsele, Stöde and Nordingrå. All communities with lots of newly arrived refugees.

On each visit we had the following amounts of participants:

Fränsta Skola 220 pupils, 40 public visitors

Junsele Skola 230 pupils, 85 public visitors

Stöde Skola 330 pupils, 200 public visitors

Nordingrå Skola 110 pupils, 100 public visitors

One of the schools in Härnösand has had a lot of problems caused by the refugee situation and racism. Because of the problems we invited that school during a few days to learn about DNA and humans as relatives and not races. About 90 pupils participated in those workshops.

On March the 12th Härnösand celebrated 431 years as a town and Technichus had an open house event. 150 participants visited the lecture we held on the topic of DNA and genetics connected to the similarities among people to prevent racism. Total visitors that day, that also included workshops from the train tour, was about 240 persons.

Zink's adventure	A interactive dancing adventure based on TV-games like Nintendo and mathematical problems, the Golden Ratio, atoms and solving problems together.
Electronic puzzles	In teams building different electronic devices with help of an easy click system that is easily changeable.
Alkalis and acids at home	In a problem solving way the pupils experimented on house hold products trying to understand whether they were alkali or acid. The goal with this program is to show that chemistry can easily be taught in a school kitchen or at home. As long as you know what you are doing.
Science Show	A show full of experiments to watch and learn while interacting with the performer; explosions, science safety, air pressure, the atmosphere etc.
LEGO programming	LEGO robot programming where the pupils set their own mission to solve with the LEGO robot.
Bee Bot programming	Actually a programming tool for younger children but still fun and a challenge for older children since the missions can be set higher for these small Bee Bots too.
Mechanics	The basics of mechanics shown in a box with a crank. With these small elements anyone can build a moving object in a mechanical way.
Flying rocket	The air pressure rocket is always perfect to learn about shooting angles, air resistance, streamlining and pressure.

Zink's adventure extras

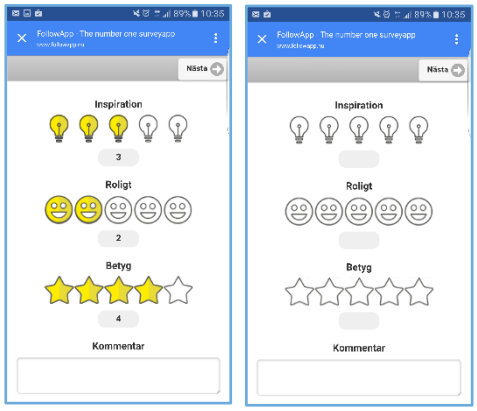
Zink's adventure was created by a dancer and a cognition- and pedagogical expert with science as primary subjects. While creating the show the teacher student of id Sweden University followed the process and gave feedback on the content and performance.

After the compact train tour Zink's adventure got some extra performances.

19-20/4 2016	Brännaskolan	51 pupils age 10 + teachers
16/5 2016	Kastellskolan	20 pupils age 8-9 + teachers
25-26/5 2016	Brännaskolan	52 pupils age 9 + teachers

"The app"

Technichus were supposed to design and buy a app (application – android and iOS) for the project in cooperation with Chalmers University in Gothenburg. Unfortunately, when our project already had started we fpound out that the app (LoopMe) did not suite our demands. To get data from LoopMe every teacher/explainer/pedagogue on every show/workshop had to keep up a dialogue with every participant for quite some time to be able to measure the impact and learning level. In a tour it is impossible to keep up a dialogue with each and every person you meet.



After realizing the problems with LoopMe we contacted the local office of a company that works with IT-solutions worldwide, CGI. They already have designed a website with the design of an application for surveys, FollowApp. We constructed an intro site in each language represented in the project. The survey was then made as easy as possible no matter if the participant could read or not.

Because of the change of using this "app" instead the quality questionnaire was not included, and therefore no deeper impact could be measured. Also, the co-financing from the FSSC (Swedish Association of Science Centers) failed to appear, since FSSC went ahead with LoopMe in another project and they did no train activities in the rest of Sweden.

Choosing to cooperate with CGI and FollowApp resulted in a different survey model. The survey was also supposed to be used by the BioPhilia project and therefor got that logotype as intro page (followapp.nu/lander/biop) were the user can choose language. The next page Is easy to understand with symbols and very little text to describe the experience.

This solution was much more economic but after using it we realized that it did not give enough data to trust for an evaluation of the project.

Evaluation

Results from "the app" described above is weak. Reasons are probably a mix between the following:

- The tour members forgot to ask participants to do the survey
- The participants did not have access to smart phone or tablet/computer

- The participants had access to the above but had not access to internet
- The participants did not go through with the survey despite the fact that they had access to equipment and internet

The result of the overall expected outcomes:

• to promote innovation in schools through the development of teaching methods that bring together knowledge, creativity and technology, and can be adapted to all school levels, institutions and businesses.

And…

• wedge traditional teaching practices through a cross-disciplinary approach, across all ages, subjects and disciplines.

The tour along with the shows and workshops started a journey for both our science center, as well as the schools we visited and the university cooperation. Two of the schools have contacted us after the tour to plan future teacher training for their staff.

Since the Mid Sweden University decided to profile their programs with inspiration of the methods of the project we must consider that a good result.

The methods a science center usually uses is called “science center pedagogics”. The method is not defined but often referred to. As a result of the Nordic Knowledge Train project, Technichus, the Mid Sweden University and the Interactive Institute will start a definition and content research project, probably in 2017. Multi-disciplinary teaching is one of the main focuses in “science center pedagogics”.

• encourage young people´s interest in Natural Sciences and technology, and thus progressively increase the competitiveness of the Nordic Countries.

The work to primary change teaching, to secondary increase young people’s interest in science is a long process. We have just begun, but found out that this method of working with STEM + arts is on of the keys to get closer to the wide goal.

Other expected outcomes and results:

- Help students to put into words their feelings when learning is taking place (the app)

This goal has not been reached due to the change of the app and lack of time to quality communication with the participants during the tour.

- Help teachers to understand when interdisciplinary methods are best choice of teaching

…and…

- Help teachers to learn methods of interdisciplinary learning and give them concrete examples

One of the ideas from the project was the question “how does the environment affect the teaching process?”. Therefor we built two Bazaar environments and installed at two schools, in agreement with the principals. The teachers are now working in teams trying to work out which methods they can use in each subject during the school year, using these environmental changes.

Still there is a problem in schools that the freedom to choose method is overrun by the fear of not having time to do all things decided in the curriculum. Therefor there is easy and safe to

use the school books, including planning, tasks, each episode of each subject to be sure that the year has been used in the right way. Teachers need time to do changes this extensive. The teacher's education needs to be less divided into subjects and also inspire to interdisciplinary teaching.

- Give teachers a tool to measure when their students actually feel the learning process inside

Since we did not chose to work with the first app LoopMe, we did not get this result from the Swedish knowledge train.

- Help science centers to understand, document and measure learning, to spread all over the country

The results from our tour, from the environmental changes and the A in STEAM idea will be presented to the FSSC in the autumn of 2016.

Dissemination

In Sweden, the Mid Sweden University has a teacher's educational program and researchers following projects which have a focus on learning. If the results are – as we hope – good and we will be able to find good examples for motivation and learning the university will help us spread the results.

The results of the participating in Swedish Knowledge Train and BioPhilia as well as the results from the coming projects will be presented on the conference in Iceland in October and on the website later on, as soon as presentable data can be published.

Thoughts on future collaboration
Technichus journey with the Nordic Knowledge Train has given fruit in so many ways. Some are in-house things like:

- Our staff has gone through a deep and wide in-service training.
- We have broadened our collaboration with cultural performance artists and artistical groups.
- We have a decision that Technichus from now on will visualize STEM with STEAM factors and performers.
- We have created STEAM-collaborations in two other projects (**M.E.D** – Method of Entrepreneurship and Design; **Creative Momentum** *http://www.thecreativemomentum.com/*)

Outside the house we have:

- Built a in-house science center in a school, with experience from the tour to add the "extras" for the A in STEAM (*http://technichus.se/nu-finns-vi-pa-ljustadalens-skola/*)
- The contacts from the tour has led to a entrepreneurial project for youths in those areas, **Ung Landsbygdsentreprenör**. For us, the creativity is as much fuel to STEAM as well as being a entrepreneur.
- We are holding the science subjects in a school 50 km from us, were we also educates the staff in the STEAM and science center methods
- We got an agreement with the Mid Sweden University to host more of their educational and didactical parts of the teachers program and they want to use this as a profile of their university. This is HUGE!

We will use the experiences in the future to:

- Keep on inspiring each other throughout the project group and colleagues at home
- We would like to have some digital/Skype exchanges for children using STEAM as a learning method and teaching other children at the same time
- We would like to participate in a ERASMUS-like project to further on spread the methods to more teachers
- We will use the STEAM-method to build trails in our region where science is experienced through arts and sights around where people spend time but not raise their eyes, ears and senses.

And so much more….