

TENUM (Technology, Entrepreneurship, Natural science, Outdoor education and Mathematics)

Gävle, Sweden

Analytical Case Study

December 2010



Name of the URBACT Project concerned: ESIMEC

Date: December 2010

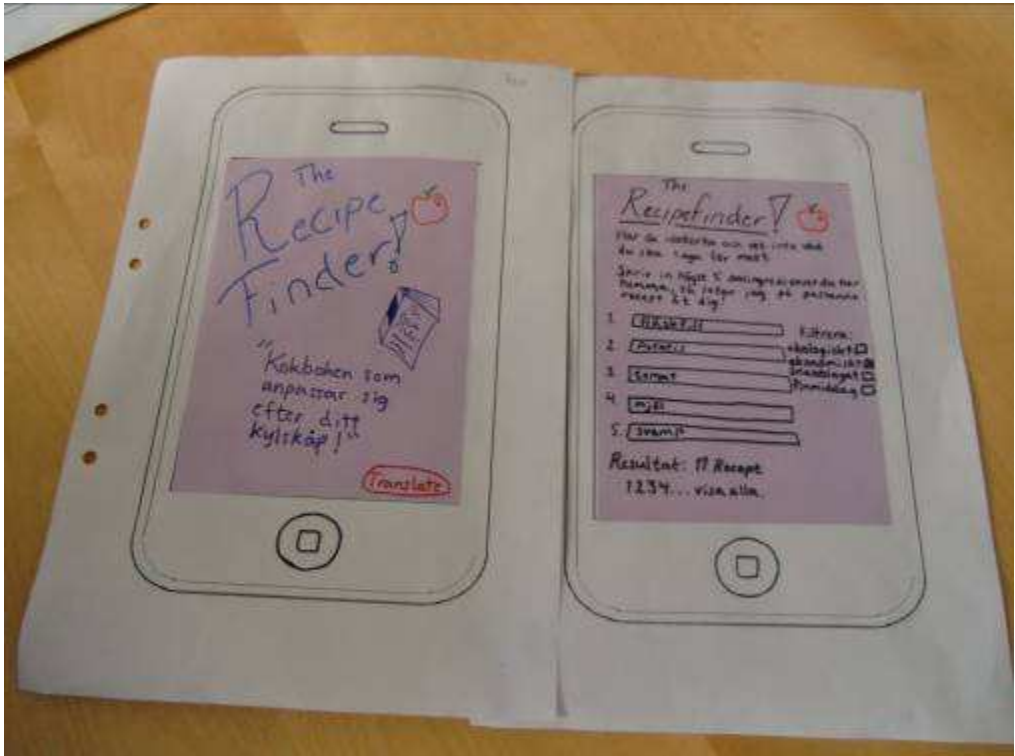
<p>Overview</p>	<p>TENUM stands for Technology, Entrepreneurship, Natural science, Outdoor education and Mathematics Based on a US model (Natural Sciences Resource Centre) this was introduced in Gävle, Sweden in 2003. The overall aim is to deliver these subjects in a holistic way to young people and thereby to stimulate young people to consider non traditional careers in these areas. In practical terms this means educating teachers and cooperating closely with the local university and businesses in order to more fully understand the future requirements of the workforce. Today 70% of pre schools and 100% of schools in Gävle work with natural science and technology in a more distinct way. The schools that have been part of the project from the beginning have evidence that young people have better knowledge and higher grades and are more entrepreneurial, less risk averse and more creative.</p>
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<p>Basic description of the background and setting</p>	
<p>Summary</p>	<p><i>Aim:</i> To get skilled and enterprising children and young people well prepared for employment</p>
<p>Challenges that the practice addresses</p>	<p><i>What is the real problem, need or challenge that the practice addresses?</i></p> <p>Employers in the region require people with good technological skills. This requirement is increasing and there is a lack of skilled people in these professions. To reverse the trend a positive attitude to science and technology is required in society. Basic education in science and technology is also important for each and every one of us. Since we live in a technological society we need to ensure that our young people are encouraged to develop the skills and attributes needed in the future workplace and are provided with the tools to do so.</p>
<p>The Context</p>	<p><i>What are the specific features of the context that have shaped the practice?</i></p> <p>The policy context which formed the backdrop to the development of this initiative has been very influential:</p> <p>Before this initiative was developed, children in pre-school and schools had limited teaching in science and technology. Most of the teaching at that time was in Biology. One of the reasons for this was the teachers' lack of education in physics, chemistry and technology. Children and teachers had a very traditional picture of work places in industries and other technological companies.</p>

	We believe that an updated picture would help to get young people more interested in working in these companies.
Aims and objectives	<p><i>What are the key aims of the practice and in what way do they contribute or add something to existing approaches?</i></p> <p>TENUM is based on the model originally developed by the Natural Science Resource Centre in the US. This was established in 1985 by the Smithsonian Institution and the National Academies. Its mission is to improve the learning and teaching of science for all students in the United States and throughout the world.</p> <p>The key objectives are:</p> <ul style="list-style-type: none"> • To increase young peoples' awareness of an interest in careers in science and technology • To involve employers in shaping their future workforce • To ensure that teachers have the skills and attributes needed to teach science and technology to young people in a modern and relevant way • To develop and strengthen capacity in science and technology and meet the skills needs of existing and future employers
Social Innovation	<p><i>In what way(s) was this practice new (in the city, in the Member State, in the world)?</i></p> <p>We start working with science and technology when the children are one year old. School classes have contact with work places and companies and visit them. This is then followed up in the classroom.</p> <p>We are developing a science centre with focus on local industry and this will include a simulated workspace in which young people can get a real "feel" for what it is like to perform various business roles – e.g. product development, marketing etc.</p> <p>We also run a Summer School for girls where they work with a company (e.g. Sogeti) to design an Application for a mobile phone. They meet with company representatives to discuss their ideas and there are opportunities for commercialisation.</p>

Case: Concise description and explanation of the practice	
Main components or parts of the practice	<p><i>What are the key components or elements of the practice?</i></p> <ul style="list-style-type: none"> • Teachers' education • Networks and networking • Equipment and literature to pre-schools and schools • Connection / activities between schools and companies arranged by the project to help companies reach out to young people and understand them better and to help young people understand the future workplace better • Leisure activities (natural science and technology) for children e.g. summer schools <p>Individual activities include:</p> <p><u>Teachers / school staff</u></p>

University courses – a total of 116 teachers have been trained at the university of Gävle at a time which suited their work commitments.
 Education days – focused on-site training for teachers looking at a specific theme to be taken forward with the children.
 Large lectures - e.g. in 2010 lectures took place for teachers in “building and construction in pre school” (240 participants); “making science and technology interesting and relevant” (100 participants) and “Children and Science: Discover, Explore, Learn” (350 participants).
 Theme days focusing on specific areas of science and technology – e.g. light and sound, biotechnology for ages 14 to 18, How to work with technology and design in an entrepreneurial and language developing way, outdoor education in mathematics for teachers with a high proportion of migrant children.
 Study days – 5 per year with an average of 100 participants
 Conference participation by teachers e.g. to learn about Cooperation between schools and industry
 Pre school and school workshops
School children
 Workshops
 Company visits – where the company gives an introduction to their business
 Summer courses – e.g. one which looks at gender equality in the labour market – girls in technology, boys in childcare.
 Weekend and holiday activities in museums and libraries




Mobile phone app developed by Gävle pupil

When was the action started and what sparked it off? When did it end? Or is it still ongoing?

Timing - Start and duration

The initiative started in 2003/4 and is still going.
 It started in recognition of the fact that the region’s business base had an emerging skills need in science and technology which could not be met from the indigenous population.
 This is a long term project with long term goals and is based on a need to change the way that careers and science and technology are perceived by young people.
 The initiative has been driven by the City of Gävle in close partnership with business and the university.

<p>Process - Development over time</p>	<p><i>What were the key stages of implementation?</i></p> <p>The initiative includes the following areas of work: We started with a survey to the teachers about their competence and developed further education after their needs and requirements. Meeting with principals for information and asking about the needs of their organisation. Networking with staff from pre-schools and schools. Support by the government of our school-administration in the city of Gävle with a steering group. Making project plans in long term and short term for developing and ensure the efforts.</p> <ul style="list-style-type: none"> • Curriculum; an investigative work method with access to thematic experimental units • Material Support; • Professional Development; continuous competence development for teachers • Assessment; ongoing evaluation of children´s and young people´s learning • Administrative and Community Support; local cooperation between the schools, the municipality, industry, higher education, and others.
<p>Overcoming challenges</p>	<p><i>What were the set backs and obstacles faced? How were they overcome?</i></p> <p>Economic – limited funding. Sometimes it is hard to get head teachers to approach this issue strategically – they have many conflicting priorities. There is a lack of time for teachers to undertake training, plan their company visits and make relevant tasks There is often a lack of time for teachers and companies to meet.</p>
<p>Transnationality</p>	<p><i>How did the actors use transnational exchange to develop the <u>practice</u>?</i></p> <p>The NTA school programme that we work with is imported from USA. One of our pre-school projects was inspired from a huge project in Germany.</p>
<p>Key actors</p>	
<p>Main actors involved</p>	<p><i>Who had the idea? Who were the main players behind the action?</i></p> <p>Originally the idea came from the US – Natural Science Resource Centre. This was then further developed in Sweden by NTA (Natural Science and Technology for All). Within Gävle itself the school administration within the municipality led local implementation and was the driving force behind engaging local business, schools and university.</p>
<p>Coordination mechanisms</p>	<p><i>What was the dynamic between the actors? How did they coordinate the action?</i></p> <p>The coordination function is delivered by the Municipality of Gävle. The mechanisms are largely informal – meetings and discussions are organised between schools and businesses on a regular basis.</p>
<p>Participation</p>	<p><i>How were the residents or users (or target groups) involved in the action?</i></p> <p>The users are teachers and children and both are involved in ongoing evaluation of the initiative and activities. Activities are developed in consultation between teachers and business and are tested with groups of children before being rolled out more widely.</p>

Supporting programmes and funding sources	
Total cost and Sources of funding	<p><i>What was the total funding and how was this broken down?</i></p> <p>From 2003-2010 – Total: 9 million skr (nearly €1m) split as follows: The city of Gävle: 7m sk Erik Johan Ljungbergsfond (an educational fund): 2m sk</p>
EU financial contribution	None
Annual budget in Euro	<p><i>What was the annual budget (in the case of revenue projects)?</i></p> <p>The last year we've had a budget of €200 000</p>
Immediate and lasting results	
Overall impact	<p><i>What was the overall impact on the original goal of the project and its specific objectives? What was the added value in terms of improvements over the original starting situation?</i></p> <p>Science and technology are more integrated into the school curriculum through the project.</p> <p>The project has stimulated more variety in the ways the children and young people learn about science and technology and they appreciate this variety.</p> <p>The teachers have more knowledge and feel more comfortable working with these subjects</p> <p>We can also see that the teachers “grow” in their self-confidence.</p> <p>We can see that students choose science and technology programs in gymnasium (secondary school) after participating in the activities of the project.</p> <p>The companies are interested to work together with pre-schools and schools</p> <p>We hope that in the long run this project will contribute to narrowing the skills gap in the region in the field of science and technology</p>
Beneficiaries	<p><i>Who are the main beneficiaries of the project?</i></p> <p>Children and youngster, teachers, businesses and in long-term the society and our region</p> <div style="text-align: center;">  </div> <p>Children talk about their future at a national conference</p>

Concrete results	<p><i>What was the impact on monitoring indicators linked to objectives?</i></p> <p>100% of the schools F-6 works with the school program NTA 50% of the NTA themes are connected to a company</p>
Impact on governance	<p><i>How has the action changed the way things are done in the city?</i></p> <p>The city of Gävle is now investing even more in these projects since they have seen that they are successful. Employers are keen to reach out to young people and to get involved in shaping their education.</p>
Lessons to be learnt	
Success factors	<p><i>What were the key factors that led to success?</i></p> <p>Dedicated project resources – time and money The project leaders' ability to be enthusiastic, lead, structure and organise. The project leaders have background as teachers and have experience of a broad span of ages. The project grows incrementally but not too fast. The timing – the businesses are more aware of their future need of educated people. They see the importance of working together with schools to skill the workers of the future. The city of Gävle has given the project power to implement.</p>
Barriers, bottlenecks and challenges	<p><i>What obstacles were encountered, what pitfalls are to be avoided, what are the ongoing difficulties?</i></p> <p>I n the beginning of the project many activities were offered to the teachers which meant that had difficulties choosing - they wanted to go on everything. But they didn't have the time. You need to pick a few things with good quality instead. The main lasting difficulty is finding time for the teachers to participate in training and education for themselves.</p>

Future issues	<p><i>What issues are still unresolved? e.g. sustainability of funding, maintaining involvement of the partnership etc.</i></p> <p>Sustainability of funding Having enough of the right staff when we are going to expand more with a science centre</p>
Transnationality	<p><i>What were the positive or negative impacts of transnational exchanges? How did these inform the nature of the solutions that were developed?</i></p> <p><i>NTA – Science and technology for all STC in USA</i></p> <p>Since 1997 when the project Science and Technology for All (NTA) started in the city of Linköping, Sweden, the knowledge of this school development project was mainly spread by way of direct contacts between teachers, headmasters, development leaders and chief education officers in neighboring municipalities.</p> <p>The city of Gävle came aware of NTA when Catharina Högström had a friend who worked as a teacher in another city and they talked about NTA. The city of Gävle had at the same time received information's about NTA and they became interested.</p> <p>Gävle was invited to an information workshop at the Royal Swedish</p>

	<p>Academy of Sciences in Stockholm. The municipality sended in an application to start working with the project, describing how it plans to organize the activities in order to give to each participating teacher the training, instruction and materials they need to make it possible for the pupils to carry out the investigations and experiments included in each thematic area (NTA unit). A project coordinator of the municipality had been appointed.</p> <p>The city of Gävle started the project activities with a small group of teachers at only a few schools. We started in close consultation with the central NTA organization. As the interest and knowledge of the project increased a growing number of teachers are involved in the activities. The project coordinator plays a very important role in spreading the NTA to other schools and teachers.</p> <p>NTA school program has provided materials (equipment etc) for use with children and young working with science and technology In Gävle from 2003/2004.</p> <p>And it has given teachers and pupil's new ways of working with the subjects physic, chemistry, technology and biology. The concrete materiel stimulates and gives meaningfully learning.</p> <ul style="list-style-type: none"> • The pupils have an opportunity to learn about and understand science, not just facts but also by processes and ways of seeing, discovering and describing. They develop their ability to communicate about science with the help of words and terms. • Among the participating teachers, science is no longer seen as so difficult and demanding. They testify that they have changed their way of asking questions to be more open-ended. <p>Germany-pre schools Haus der kleinen Forscher - Germany Gävle was the host city of a pilot project that Sweden's' National resource center in physics (NRCF) at the University of Lund started in 2009. They had funding from The Swedish National Agency for Education to extend their activities to include more of pre-school. NRCF wanted to look closer at a German pre-school education program called <i>Haus der kleinen Forscher</i> which means Little scientists' house, se more at http://www.hdkf.de/ . NRCF visited Berlin a couple of times and then started to translate and rework the material from Germany. It was particularly interesting to see what kind of organization and structure they had built to spread the concept to thousands of pree-schools all over Germany. So far five pre-schools in Gävle have participated in the project.</p>
Duration	<p><i>Will the project continue during the coming months / years? In what form will it continue?</i></p> <p>Yes it will continue until at least 2012. Part of it will go on as a project and part of it will be mainstreamed within existing structures.</p>
Transferability	<p><i>Does it appear that the practice is capable of transfer to another situation?</i></p> <p>Yes both to other cities and other situations / contexts.</p>
Expert opinion	<p><i>What makes this case interesting from an external perspective?</i></p>

	<p>The opportunity for children and young people to get involved with business and working life at an early age. The long term investment in small children and their education which will lead to even longer term economic benefits.</p>
<p>Stakeholder opinion</p>	<p><i>What makes this case interesting from each key stakeholder</i></p> <p>Children get a good picture of different science and technology professions. Teachers get more self-esteem and knowledge. Society get a wider technological knowledge. Companies get a better educated and more skilled workforce.</p> <p><u>Business, for example</u></p> <p>IT-business <i>"We cooperate with the schools to strengthen our brand. We also want to give a nuanced picture of different types of tasks in a IT-business. To make a platform for future recruitment. We hope that young will get a positive image of our working and company and perhaps get a will to work in the business".</i></p> <p>Business that provide water to the city of Gävle. <i>"Children and young are an important group for us to reach with information. If we start with the small children we can reach our long term goals with sustainable society since they don't have preconceived opinions. We also hope that our work with children and young will help us to recruit skilled people. We also cooperate with the university of Gävle and have developed a new education".</i></p> <p>Business paper mill <i>"Our ambition to work with schools is a combination of social responsibility and opportunities to show young people and school staff a variety of professions in our business. The cooperation makes it easier to: Influence the educations Recruit Meet school staff Ensure that we in a long term get persons with right qualifications Show the wood industry as a business We hope that contact with our company gives the pupils a positive image of the company that leads more pupils to technology educations. We want to be a help in their future choice of profession".</i></p> <p>Recycling business in the city of Gävle <i>"We cooperate with schools to reach out with our information. It is a easy way to reach out to a group that is responsive. At the same time we want to show a functioning brand in the business. In long term we se that we can influence education".</i></p> <p><u>Teachers</u> <i>"We think it is important for the pupils to have variation in their education. They need to see the school as wholeness with the society. The pupils see that the knowledge they get in school are used in real situations".</i></p> <p><u>Children and young people</u> Age 10-12 <i>"When we think about doing a visit to a company we think that it is interesting and exciting. It is fun to look at different things that the company can show us. We also think about how it is to practise on that company. When we have been on a visit we became aware of how much it is to do on a working place. We became interested to go there</i></p>

and have our practise. It is interesting to learn more about the company and what they do. It is also interesting for us to learn more about them because it helps us when we get older and we are going to educate us for a job. When we are out with our class and doing things together we get closer to each other. If we can get the possibility to visit companies it can help us and it can give us new jobs to think of when we are going to choose our education in the future”.

Age 15-16

“We were at the it-business where we designed a new application for iphones that we presented for the company and the other pupils in our group. I was nervous at first but it was good to speak in front of the others and hear their ideas. It was strengthening for me. I can imagine my self working there, developing new technology and invent new things. But first I want to work as a tour guide”.



Learning about movement and construction

Information sources	
Name of the initiative	TENUM
Country/region/city etc.	Sweden/Gävleborg/Gävle
Administering organisation(s)	<i>Who was the grant recipient? Who did the work?</i> The school administration
Contact details of administering organisation(s)	<i>If the reader seeks further information who can they contact?</i> Sofi Jonsevall Catharina Högström
Interviewed persons	Sofi Jonsevall + 46 76-803 31 64 sofi.jonsevall@gavle.se Catharina Högström +46 26-17 83 94 catharina.hogstrom@gavle.se
Other documentation sources	The NTA project is continually evaluated. Professor Hultman at University of Linköping has been responsible of the two latest evaluations during the academic year 2001/02 and 2002/03. The aim of these evaluations was to deepen our understanding of how the interaction between teachers and students is realized during instruction in science. Some conclusions of the evaluation are:

	<ul style="list-style-type: none"> • Pupils and teachers feel happy with the NTA program. The material fills a need and teachers and pupils have great opportunities to develop within it. But it demands active participation on the part of them all. • The pupils have an opportunity to learn about and understand science, not just facts but also by processes and ways of seeing, discovering and describing. They develop their ability to communicate about science with the help of words and terms. • Among the participating teachers, science is no longer seen as so difficult and demanding. They testify that they have changed their way of asking questions to be more open-ended. But this needs some caution questions and instructions that are too open-ended can be very confusing to the pupils, • The collaboration between teachers in the working teams can be developed in a similar way in future but it can improve. The teachers should be given more time for discussions and to learn more about the nature of science.
Website URL	www.gavle.se www.nta.kva.se
Main author of the case	<i>Sofi Jonsevall</i> <i>Catharina Högström</i>

Further educations/activities taken place 2003-2010

TENUMs project leaders; Sofi Jonsevall and Catharina Högström are responsible of most of the activities. When they don't deliver themselves they order it from other organizations or partners. See list below.

Teachers/school staff:

Universitycourses

A total of 116 teachers has taken courses in the University of Gävle. The courses were specially designed to fit the needs of the schools and pre-schools in Gävle.

Education days

We arrange different kinds of education days, some of them we help the schools with a program on their ordinary study day, some is for a group with a special theme and some is for larger groups of teachers.

Large Lectures

Once or twice a year we hire a well known lecturer to come and speak to our teachers free of charge.

Mia Mylesand talked about building and construction in pre-school, 240 participants.

Eva Funck inspired teachers in the lower school years in how to make science interesting and concrete, 100 participants.

Anders Jidesjö researcher at Linköping University, delivers education, 150 participants

Bodil Nilsson and Lillemor Sterner are teachers at Stockholm University and two of the authors of the book "Children and Science – discover explore learn" came to speak about the content to 350 pre-school teachers.

Theme days

We offer a variety of themes depending on the teachers' wishes and what age they are working with.

13 different themes with a total of 320 teachers have occurred. Some examples:

Teacher at the university deliver and has education on light and sound, Biotechnology for teachers with pupils in the age 14-18.

How to work with technology and design in an entrepreneurial and language developing way.

Outdoor education in mathematics for teachers with a high proportion of immigrant children.

Benefits and risks with sunlight and UV-radiation.

Power point education to increase the computer knowledge

Study days

Every year school has study days, TENUM has been asked to arrange the program
5 study days with an average of 100 participants

Conference participation

We arrange that a lot of our personnel can go to national conferences in the specific subjects. We subsidize the trip, accommodations and participation fee. We've been to seven big conferences with a total of 430 teachers.

SSA Cooperation school and company

Technology

Science

Mathematic

Out door education

Pre-school work shops

Sofi Jonsevall has been to 40 pre-schools and met nearly 500 pre-school pedagogues.

School work shops

Sofi Jonsevall has been to 6 schools and met about 70 teachers

NTA introduction

2-4 at each year, 20-50 participants

NTA unit-education

28-32 at each year, 150-250 participants, the education delivers by a person that has a special education on that unit delivered by NTA national

Network, local, regional, national

Network in NTA 300-350 participants, two times a year

Network in pre-schools, 40 meetings with an average of 10 participants

Network in school, 10 meetings with an average of 15 participants

Network regional NTA, 30 government work together, we arrange them together in the regional network

Network national 108 members in NTA society, delivers by NTA national

Visits at companies

Some of the network meetings are located at companies and the company gives an introduction of their business

Visits at pre-schools

TENUM arrange study visits at pre-schools in other cities. We have been to four pre-schools with a science and technology profile. 130 pedagogues joined these visits.

Some of our preschools have also had visits from other cities and several articles have been written about their fantastic work.

Children and young:

Work with NTA units

5000 pupils each year (86%)

400 children at pre-schools

Summer courses

The city of Gävle has summer courses to increase the gender equality on the work market. Girls in technology, boys in child care and boys and girls in health care. TENUM arrange courses for girls in technology and in the last five years have 105 girls in the age 10-12 and 135 girls in the age of 15 participated.

Activities on weekends and holidays

2600 children have since 2007 participated in activities arranged by TENUM on museums and libraries and other kind of happenings.

Cooperation with companies

8 companies is connected to 11 NTA units

25-30 visits during this year connected to NTA-units

A company also wants to go to the schools and meet the pupils there.

Organizations involved

National resource center in Physics, Chemistry, Biology, Mathematics and Technology



The University of Gävle and other universities
Different companies, both public and private
Other departments in the city of Gävle
Other cities
NTA

URBACT II

URBACT is a European exchange and learning programme promoting sustainable urban development.

It enables cities to work together to develop solutions to major urban challenges, reaffirming the key role they play in facing increasingly complex societal challenges. It helps them to develop pragmatic solutions that are new and sustainable, and that integrate economic, social and environmental dimensions. It enables cities to share good practices and lessons learned with all professionals involved in urban policy throughout Europe. URBACT is 300 cities, 29 countries, and 5,000 active participants

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