Computing at School in Sweden - Experiences from Introducing Computer Science within Existing Subjects

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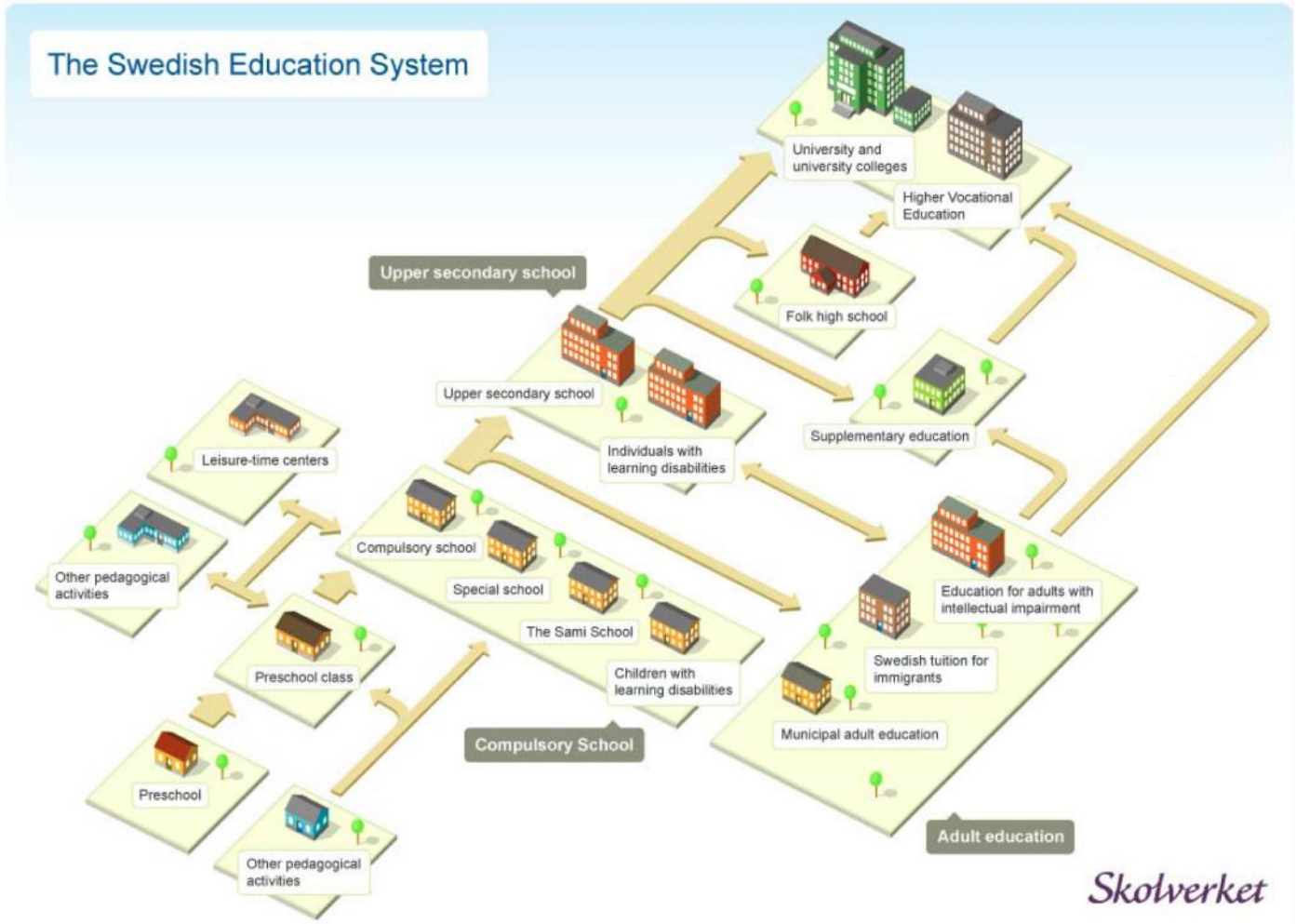
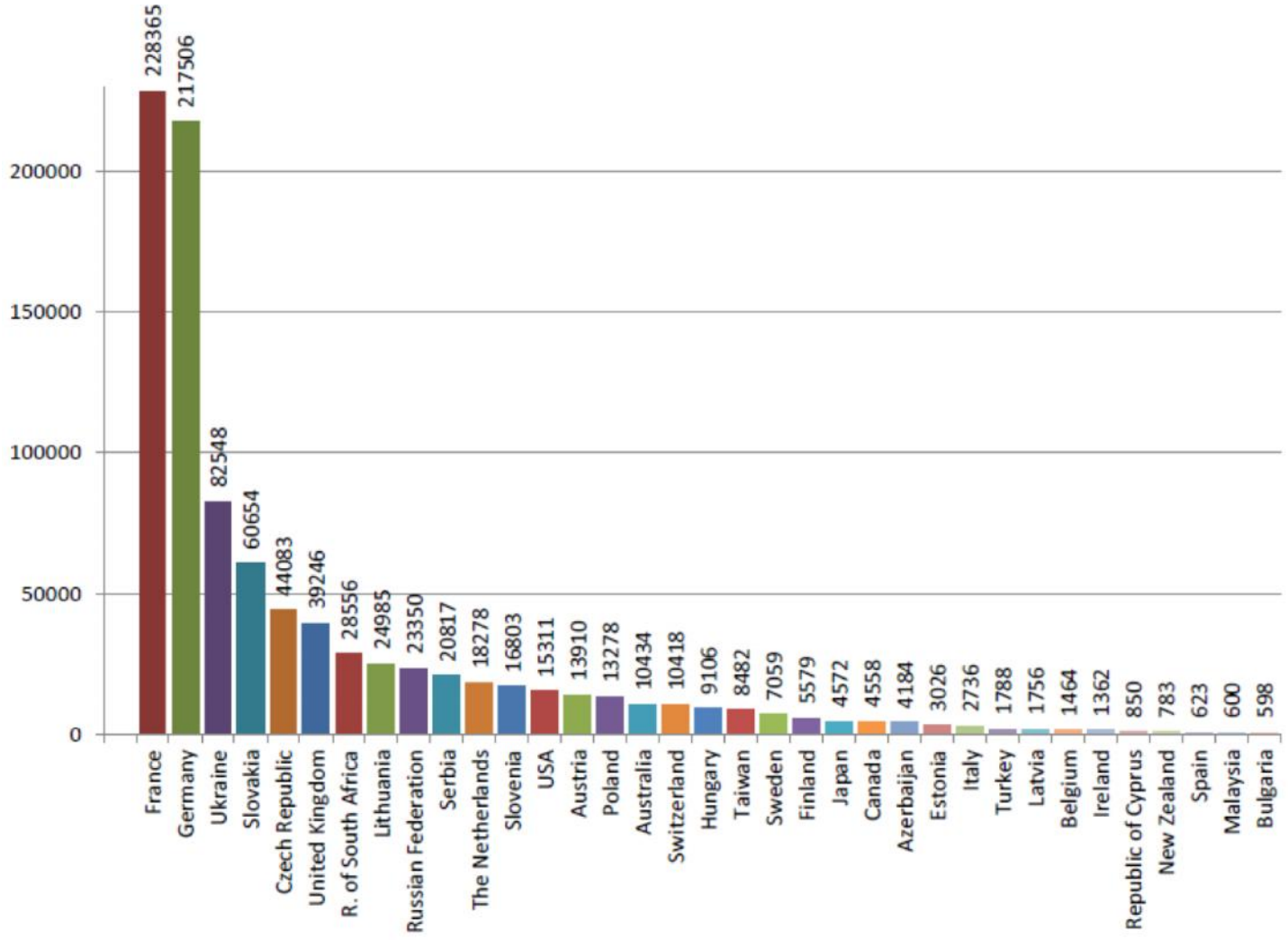

The Swedish Education System
University and university colleges
Higher Vocational Education
Folk high school
Upper secondary school
Upper secondary school
Individuals with learning disabilities
Supplementary education
Leisure-time centers
Other pedagogical activities
Compulsory school
Special school
The Sami School
Children with learning disabilities
Education for adults with intellectual impairment
Swedish tuition for immigrants
Municipal adult education
Preschool class
Compulsory School
Preschool
Other pedagogical activities
Adult education
Skolverket

Bebras in Sweden

- International problem-solving challenge on computational thinking arranged annually in November.
- Initiated in Lithuania 2004, Sweden has officially arranged the contest since 2012
- Fun and motivating tasks, aimed at raising interest in computer science among children and youth aged 8-18
- 2014: 925 000 participants from 35 countries (Sweden: 7 059)

Category	Participants	Teachers	Schools	Cities	Boys	Girls
Mini	1148	61	42	37	565	583
Benjamin	1499	54	51	41	767	732
Cadet	2045	62	60	43	1116	929
Junior	1701	39	37	31	924	777
Senior	666	22	22	20	561	105
TOTAL	7059	189	150	92	3933	3126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Slovakia
Czech Republic
United Kingdom
R. of South Africa
Lithuania
Russian Federation
Serbia
The Netherlands
Slovenia
USA
Austria
Poland
Australia
Switzerland
Hungary
Taiwan
Sweden
Finland
Japan
Canada
Azerbaijan
Estonia
Italy
Turkey
Latvia
Belgium
Ireland
Republic of Cyprus
New Zealand
Spain
Malaysia
Bulgaria

Linköping

- Innovation project on Introducing Computational Thinking in K-9
  - Developed a two-part workshop for teacher training
  - Developed teacher activities in 4 different subjects together with the teachers
  - The municipality is very active and interested
- CoderDojo
  - Voluntary initiative to provide creative and fun programming activities for kids 7-17 where the kids drive their own learning with support from mentors
- Kodcentrum
  - Private initiative providing a programming course to kids based on Scratch
- EU Code Week
  - Cooperation between the university, the municipality and the local science park

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Luleå: Background

- Luleå University of Technology in close collaboration with Luleå Municipality.
  - Professor Peter Parnes and Principal Agneta Hedenström
- Goal: Get more teachers, principals and school leaders involved in digitalization in schools through:
  - Hands-on work and peer-learning
  - Mixing Maker Culture, Computational Thinking and Entrepreneurial Learning
  - Focus on the gender issue and getting more young females interested in ICT and STEM.

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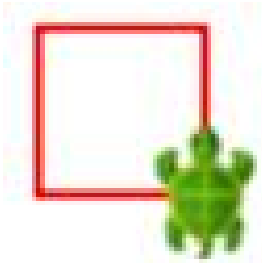
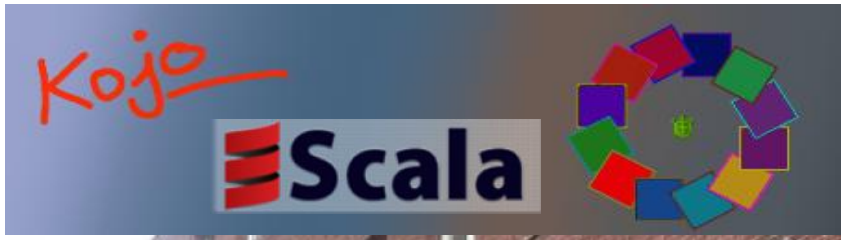
Luleå: Examples of Activities

- Pedagogical Pubs with TeachMeet
  - Inspirational talks and teachers presenting to each other
- Open Educational Workshops, CS4HS Luleå 2014
  - Give educators hands-on experience with modern technology
- Student Inspiration – EU Code Week, Hour of Code and School Visits
- Making in Schools – Luleå Makerspace and the Skaepiedidh Project
  - Create meeting places for Making in schools and collect good examples on a national platform for making: www.skapa.how.
- Develop teachers' educational programs with Computational Thinking and Making

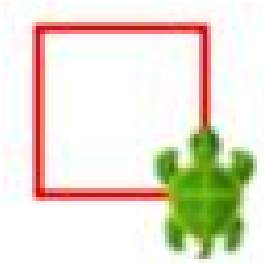
Lund

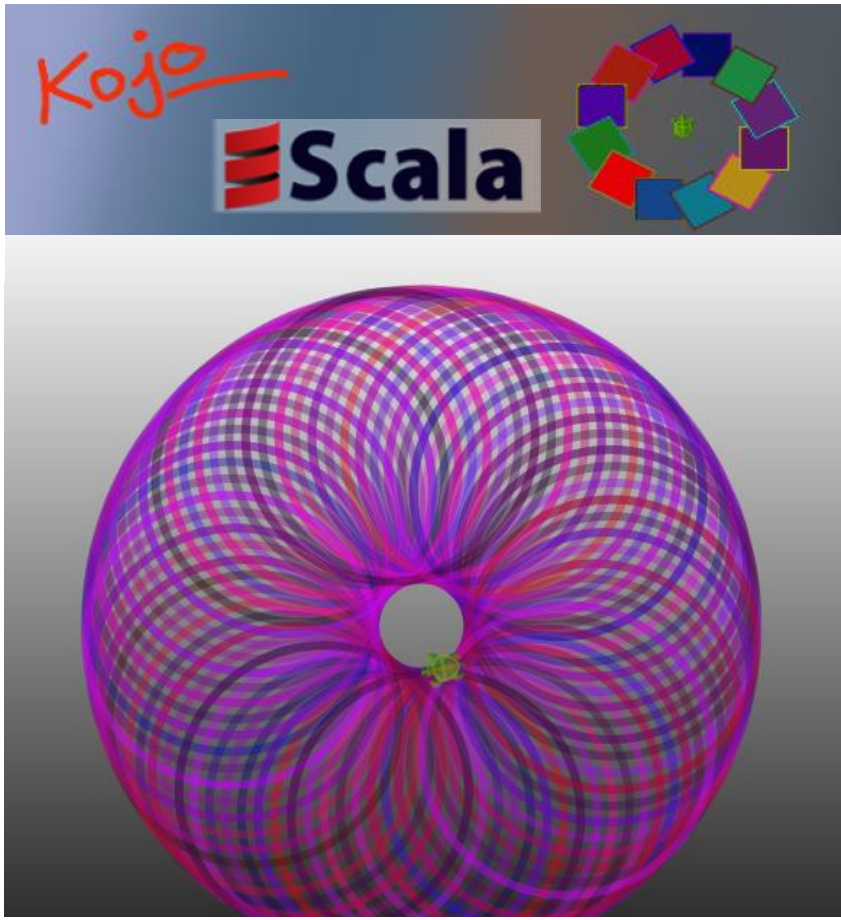




- LTH Science Center "Vattenhallen" started a project called **"Programming for everybody"** (PfE) in 2012, funded by LTH and a donation from the LMK foundation.
- The project develops a **free and open** pedagogical concept including a series of progressive **challenges** using turtle graphics in the modern & professional **Scala** programming language and the open source programming tool **Kojo** for young learners. [See links in the paper]

Lund





- Since the PfE project started, more than **10'000 young learners** have experienced programming using our **challenges** in Kojo and Scala during visits to our science center.
- More than **150 teachers** have passed our programming courses comprising 2-3 half-days with assignments in between to try out **programming in class using Scala & Kojo**.
- Teachers then **share their experiences** with each other, including new challenges that they develop in relation to their specific subject curricula wrt existing assessment criteria.

Stockholm

- Despite the high rate of tech companies in Stockholm, the city is not very progressive when it comes to development of IT in schools.
- Sjöstadsskolan started to explore the possibilities with CT within the curriculum in February 2013.
- Pilot project initiated by politicians within the City of Stockholm, on how to scale up programming in schools on a larger level just started.
- The big differences between areas is a challenge.
- The possibilities are great with a lot of knowhow in tech.
- Many initiatives to support girls in tech; Geek Girl Mini, Tech Girl, Girls Code, MakerTjej, Tjejhack and the Tekla Festival.

Lessons Learned

- A lot can be done with limited resources!
- The concept of computational thinking is very well received. More than programming.
- We mainly advocate introducing programming as part of the existing subjects.
- Private and voluntary coding clubs are becoming popular but can't meet demand.
- Leverage science centers and leisure time centers to reach a wider audience.
- Grass root activities, both from teachers and others, have a large impact.
- The next step is to turn the grass root initiatives and into national policies.
- We have a vision and some pretty good ideas on how to proceed.
- The challenge is to provide the research foundation for computing in school, scale up, and reach out to most schools, teachers and pupils.

Ways Forward

- Establishing the term "Datalogiskt tänkande" as the Swedish term for computational thinking.
- Engaging as many schools as possible in Bebras, in order to stimulate the interest for computational thinking.
- Supporting informal activities such as CoderDojos,and Maker Spaces which play an important role in giving students hands-on experience with, for instance, programming.
- Collaborating with municipalities wanting to introduce computational thinking at a larger scale.
- Supporting teachers in developing concrete example activities and lesson plans on introducing different aspects of computational thinking in a variety of subjects.
- Designing concrete suggestions for professional development for teachers on computational thinking, for instance, in the form of a nation-wide MOOC supported by local study groups.
- Engaging in continuous discussions with teacher education programs in order to introduce at least one compulsory course on computational thinking for all preservice teachers.
- Developing suitable means for assessing computational thinking, for instance based on Bebras activities.

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