Robotics and early-years STEM education

Experiences from Sweden

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botSTEM implements robot-based inquiry teaching activities

Enhancing scientific literacy in young children

Teaching aids
- Framework
- Best practices
- Toolkit
- Gender inclusive
- Assessment of activities

Developed abilities
- Reasoning
- Reflection
- Questioning
- Modelling
- Justifying decisions
- Communicating

Search and development of activities

A suggested framework for integrated STEM

- Holistic approach
- Child centred
- Problem based
- Project based
- Inquiry teaching
- Engineering design
- Real world problems

Search and development of activities

Toolkit – freely available at *botstem.eu*
- Theoretical framework for pedagogy and robotics
- Collected and newly developed activities

Teacher initiated activities

- formulation of a learning object
- defining critical aspects
- identifying contrasts
- learning to plan for
- learning to look for

Children Initiated activities

- Spontaneous inquiry and play

Framework for implementation

Variation theory (Marton & Booth, 1997)
- Learning directed at an object of learning
- Discernment of critical aspects
- Awareness of differences between aspects

Specific learning goals
- What knowledge do we want the children to develop?
- What does it mean to understand this?
- What differs between different ways of understanding?
- How do we want them to use the knowledge afterwards

Implementation of activities in Sweden

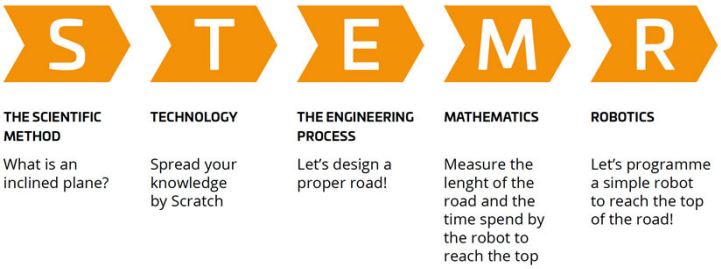
- Joint implementation and evaluation
- Video recording of implemented activities
- Development of activities – described in Addendums

Involved Swedish preschools

- 10 workteams of teachers in seven preschools
- 150 children

A Blue-bot climbing experience

Inclined plane



Example of a robot-based challenge for enhancing the education in STEM.
Let the robot "climb a mountain"
What are the scientific concepts that come into play?

Tentative results – Inclined plane activity

Teacher's Reflection

Obvious to the children what to do to
A lot of thoughts and ideas from the children
Children uses concepts and different expression
- Child: Would like to be in his brain to see what he thinks!
- Teacher: You are programming him!
- Child: But, then I am his brain!

Children's Reflection (4 years old)

When it goes too straight it slips
You shouldn't drive it straight up – you should drive it sideways
You have to go all the way to the edge!
I have programmed it to go up the hill!

Continuation and next steps

Ongoing analysis of video recordings
Analysis based on
- Variation theory (Marton & Booth, 1997)
- Joint Action Theory of Didactics (Sensevy, 2012)

Implementation of re-designed activities
Interactive community on Moodle
Evaluation and dissemination of results

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