Changing constraints in science teaching activity in Icelandic schools

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The study

• Part of a larger study *Intentions and Reality* on the status of science education in schools, funded by the Research Fund in Iceland
  – Questions about the alignment of curriculum intentions and realities in schools and classrooms

• Actual and preferred delivery of science in three school districts in Iceland
  – Multi-methods – ISCIQ electronic survey before school visits, on-site interviews
  – Twelve schools (six grades 1-10, three grades 1-7)

• Data collected October-December 2006
Structure of presentation

Theory and background
1. National curriculum – a process of deliberation
2. Recontextualisation and pedagogic discourse (Bernstein)
3. Activity theory and activity systems (Engeström)
4. Activity systems and pedagogic discourse
5. Activity components, contradictions and ‘ideal types’

Methods
The SCIQ questionnaire and activity components

Results
1. Survey results – capacity gaps
2. Results from interviews – capacity in schools

Discussion – changing constraints
National curriculum

• Compulsory education decentralised 1996
  – management at district level
  – curriculum guidelines at national level

• National curriculum from 1989
  – extensively revised in 1996-1999
  – introduced 1999
  – to be implemented by schools by 2002

• Two-step centralised deliberative process 1996-99
  – setting of goals by expert group
  – preparation of aims and objectives by teacher group

• Very few measures to support implementation of science curriculum 1999 to the present
  – at national level (curriculum materials)
  – at district/school level (courses, advisers)
Recontextualisation and pedagogical discourse

• Recontextualisation of curriculum from one setting to the next – science, society and the economy, central planners, writers, schools, teachers

• Pedagogical discourse in each setting reflects views, resources and constraints on education (Bernstein, 2000)
  – *Instructional discourse* – selection, sequencing and pacing of material, and criteria of knowledge
  – *Regulative discourse* – conduct, character and manner, and criteria of knowledge

• The instructional discourse is always aligned with the regulative discourse
Activity system and typical school practice

**Context**
- Learning theories and teaching activities
- Learning/curriculum materials
- Assessment techniques
- Classroom resources/facilities
- Teachers – used to controlling classrooms; used to dealing with finite information
- School curriculum
  - Teacher as classroom manager
  - Timetable
  - National curriculum
  - Trade union agreements
  - School buildings

**Outcome**
- Learners – expectations of a good teacher fairly traditional
- Teachers as subject specialist
- Teacher leadership
- DoL – who are experts
- Tech./prof. support
- Role of advisers
- Role of parents
- The professional community
- The workplace community
- The classroom community
- Home-school partnerships
Activity theory and pedagogic discourse
Activity theory, contradictions and ‘ideal types’

- Core of activity theory
  - Dialectical relationship between individual and collective activity
  - Contradictions present within a system
    - Primary contradictions e.g. within components, such as within rules or within tools: can be interpreted as the contradiction within an ‘ideal type’ and reality in praxis
    - Secondary contradictions e.g. between components, such as between rules and tools or between tools and division of labour
  - The resolution of contradictions leads to the development of the activity system
Methods and data

• Selection of school districts and preparation for visits:
  – AC agricultural
  – CC coastal
  – UC urban

• ISICQ – translation of SCIQ, on-line survey,
  – 75 teachers: 15 in AC, 31 in CC and 29 in UC
  – Actual capacity and preferred capacity to deliver science

• Interview protocols – principals, teachers of science and older pupils
Resource adequacy

Tools

Skill, knowledge and professional attitudes

Teachers

Rules

Time

Division of labour

Professional support

Community

School ethos and the status of science as a subject

Learners and learning

Outcome

ISICQ survey and the activity system
Capacity gaps for four extrinsic factors and one intrinsic factor (skills, knowledge and attitudes) as measured by ISCIQ in three Icelandic communities. The minimum value for the gap between current and preferred capacity is zero (09 and the maximum four (4).
Teacher views on actual and preferred capacities for science delivery in schools in three Icelandic communities, as assessed by ISCIQ.

- The value of each factor is the mean of seven questions on a scale of 1 (strongly disagree) to 5 (strongly agree).
- The lighter area represents views of teachers on the current capacity and the darker areas the preferred capacity.
Capacity of schools to deliver science 1

- **Resource adequacy (tools)**
  - Resources outside the school still poorly used
  - Poor management of resources a weakness
  - Access to science classrooms seen as an issue
  - Theme-based days redistribute resources
  - Teachers dependent on printed curriculum materials
  - Resources often seen as the first step in building capacity

- **Time (rules)**
  - Traditional timetable seen to limit practical work
  - New teaching methods require time for preparation
  - Cooperation within and between schools needs time
  - Trade union agreements with teachers limit flexibility in use of time
Capacity of schools to deliver science 2

- **Support for teachers (division of labour)**
  - Few in-service courses available in recent years
  - Some courses do not meet needs of teachers
  - Courses are not offered at suitable times
  - Authorities express interest in supporting teachers

- **School ethos and status of science (community)**
  - Science has not been a priority with school leaders
  - Developing a school curriculum has not been a priority
  - Student interest in science not overwhelming
  - Physics and chemistry particularly weak areas and more dependent on individual teachers than biology and earth sciences
  - Some attempts are made to integrate science with other areas but science itself is generally weak
Capacity of schools to deliver science 3

- Skills, knowledge and professional attitudes (teachers as agents)
  - Science as a school subject is a daunting task for teachers, with an extensive and detailed curriculum
  - Specialist knowledge of science in compulsory schools is hard to find
  - Teachers have confidence in their general teaching skills
  - Teachers offer students a fairly uniform learning experience of reading, writing and listening with limited practical activity
  - Practical work disappearing from the older grades (8-10)
Changing constraints 1

• **Time and adequacy of resources**
  – Changes in the division of labour led to improved use of time and resources
  – The changes could be traced to a willingness to increase the status of science as a school subject

• **Support and ethos**
  – Community support for science can lead to more support for teachers
  – Individual teachers can affect ethos and resource management in small schools, not least when they move between schools
Changing constraints 2

• Skills, knowledge and attitudes of teachers
  – Extrinsic and intrinsic factors are not necessarily linked – see figure on capacity gaps
  – ‘Ideal types’ of tools for science teaching are considered hard to use, such as practical or out-of-door activities
  – The regulative discourse governing conduct, character and manner of modern school pupils and the criteria of knowledge of science appears to unsettle and constrain teachers,
  – New views on the instructional discourse, such as individual learning and the use of technology, lead teachers to experience conflicts in their daily practice
Key references


• [http://home.cc.umanitoba.ca/%7Elewthwai/ApplicationofSCIQinCanadianContext.pdf](http://home.cc.umanitoba.ca/%7Elewthwai/ApplicationofSCIQinCanadianContext.pdf)