Moving into the Zone of Feasible Innovation
– towards meaningful science teaching

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Aim of the study

To address the question of how much change is appropriate in the context of science teaching and school development in three suburban schools.

• How do teachers understand and interpret the demand of the National Curriculum?
• How is their motivation and identity in science teaching?
• What activities might change some of the constraints on science teaching in these schools?
Intentions and Reality

• This study is based on a part of a larger study 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 capacity in the delivery of science in three school districts in Iceland
  – Multi-methods – ISCIQ electronic survey before school visits, on-site interviews (teachers, principals, pupils and district leaders). Analysis of the school environment (inside and outside)
  – 19 schools in three districts (75 science teachers)
    • AC agricultural
    • CC coastal
    • UC urban

• Data collected:
  – In schools in October-December 2006
Teacher views on actual and preferred capacities for science delivery in schools in 19 Icelandic schools (105 teachers), as assessed by ISCIQ.

The lighter area represents views of teachers on the current capacity and the darker areas the preferred capacity.

The value of each factor is the mean of seven questions on a scale of 1 (strongly disagree) to 5 (strongly agree).
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 (0) and the maximum four (4).
Suburban community

Skills, knowledge and professional attitudes

School ethos and the status of science as a school subject

Professional support

Resource adequacy

Time

UC, N = 29

UC Preferred

UC Actual

6
Teacher motivation and identity

• What is a competent science teacher?
  – To what extent does he meet the collective interests of the school?
  – To what extent does he meet his own interests?

The workplace-related motivation is high when the subject realizes both individual and collective interests in the same action

  – Identity …. Who I am with respect to others and myself is fundamentally related to my participation in collective activity and to individual and collective emotional valences arising from ... interactions with others ... Must provide evidence to others that I am competent

Collective - Individual +

TEACHER
Low motivation
Strong identity

Collective - Individual -

COERCED TEACHER
Low motivation
Weak identity

Collective + Individual +

COMPETENT TEACHER
High motivation
Strong identity

Collective + Individual -

COMPLIANT TEACHER
Low motivation
Weak identity

Collective interests met

Individual interests met
What do we know now?

- A project was carried out to support science teaching in the community.
- Still need more self-confidence
- Some teachers are not doing what they choose (are loyal but not necessarily happy)
Zone of Feasible Innovation (ZFI)

• Teacher beliefs about their own competence in science teaching varies between individuals
  – Their response to challenging situations can depend upon the guidance on how much curriculum change is appropriate in a given context of science teaching and school development.

• Rogan & Grayson (2003) and Rogan (2007) have proposed a theory of curriculum implementation, an idea to assess how much curriculum change is appropriate in a given context.

• The theory is based on three major constructs:
  A. Profile of implementation (in the classroom)
  B. Capacity to support innovation
  C. Support from outside agencies
Theory of curriculum implementation

Six prepositions:

1. Innovation should be just ahead of existing practice. Implementation should occur in manageable steps.
2. Capacity to support innovation should be concurrent with efforts to enrich the profile of implementation.
3. Outside support should be informed by the two constructs, matching outside support with capacity, and capacity with desired implementation.
4. All role players need to reconceptualise the intended changes in their own terms and context.
5. Changing teaching and learning is a change of culture not a technical matter.
6. There should be alignment between the three constructs and the primary level (e.g. the learning experience).
# A. Profile of implementation

<table>
<thead>
<tr>
<th>Ideal</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Implementation</th>
<th>Classroom interaction</th>
<th>Practical work</th>
<th>The nature and role of science in society</th>
<th>Assessment</th>
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</thead>
</table>

# B. Capacity to support innovation

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Teaching resources</th>
<th>Teacher factors (background, education)</th>
<th>Learner factors (e.g. background and personal situation, attitude towards studies)</th>
<th>School ecology and management</th>
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<tbody>
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<td>Ideal</td>
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</table>
### C. Support from outside agencies

<table>
<thead>
<tr>
<th>Ideal 4</th>
<th>Learning community</th>
<th>School self-evaluation</th>
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<tbody>
<tr>
<td>3</td>
<td>Professionalism, compliments for innovation and quality work</td>
<td>School self-evaluation followed by external evaluation</td>
</tr>
<tr>
<td>2</td>
<td>Ideas and encouragement from above</td>
<td>External and self-evaluation</td>
</tr>
<tr>
<td>1</td>
<td>Bureaucracy, instruction from above</td>
<td>Only external evaluation</td>
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</tbody>
</table>

#### Types of encouragement and support

<table>
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<tr>
<th>Outside support</th>
<th>Physical resources</th>
<th>Design of professional development</th>
<th>Direct support to learners</th>
<th>Dominant change force evoked by agency</th>
<th>Monitoring mechanisms and accountability</th>
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## B. Capacity to support innovation

<table>
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<tr>
<th>Ideal</th>
<th>Description</th>
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<tbody>
<tr>
<td>4</td>
<td>The teacher has outstanding knowledge in science and excellent teaching skills. He shows willingness to change, is resourceful and cooperative. He has a vision for innovation and shows professional initiative and leadership at home and elsewhere.</td>
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<tr>
<td>3</td>
<td>The teacher is competent with reliable knowledge in science. He takes active part in professional development of his job, is conscientious and tries to improve his teaching.</td>
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<td>2</td>
<td>The teacher has basic knowledge and skills to teach science. He works hard and participates in professional development. He is well connected with students and treats them with fairness and respect.</td>
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<td>1</td>
<td>The teacher lacks knowledge in science but is a qualified teacher.</td>
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**Teacher factors** *(background, education)*
Science teachers view of ZFI

- The theory was adapted to the Icelandic national curriculum and the content of the three major constructs.
- The theory of ZFI and the methods and main findings of *Intentions and Reality* was introduced to two focus-groups of science teachers.
- They were asked if it would be useful to develop and use an instrument based on ZFI to evaluate their own situation, i.e. to assess how much curriculum change is appropriate in their own context.
• The view of the teachers is:
  – The theory of Zone of Feasible Innovation (ZFI) is an useful idea to evaluate the levels of implementation and identify developmental aspirations and potential contributors and constraints to the achievement of implementing the National science curriculum.
  – They would however like to answer the SCIQ-questionnaire to assess their own views.
  – They would like to do the assessment of their own situation in cooperation with all science teachers in each school (and/or with all the schools in a local educational area).
  – Also, they emphasised the importance to have an external specialist to guide them in the evaluation process.
Conclusion

• The theory of Zone of Feasible Innovation is an useful idea to evaluate the levels of implementation.

• The next steps are:
  – to develop the constructs in detail according to the new National science curriculum.
  – ask some teachers in the schools that participated in *Intentions and Reality* to try it out and compare the results with researchers evaluation of their situation.
Next steps in these schools

- Discuss their capacity to deliver science:
  - Skills, knowledge and professional attitude
  - School ethos and the status of science as a school subject
  - Professional support
  - Time
  - Resource adequacy

- Analyse their own motivation
  - Individually (specialised knowledge)
  - Collectively in the school

- Identify priority areas through working on self-assessment using the template of ZFI.