The silence of innovation education in Icelandic science classes

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Introduction

• Here we present a research of innovation education in science lessons in Icelandic compulsory schools
• Bernstein’s pedagogical code is used to understand the development of innovation education or lack of it in science lessons
• Understanding different discourses and possible contradictions may help to clarify the potential innovation education has for developing science education
What is innovation education?

In the curriculum for compulsory schools in Iceland since 1999
Similar to Technology Education in other countries

School subject about:

- Inventing new objects, redesigning things that already exist - to enhance and improve the conditions of social life
- Students search for needs that are important to them
- Solve needs or problems
- Find solutions that can become
  - Personal solutions, new designs, technological innovations or social innovations and business ideas.

Innovation education (IE) requires flexible organization, giving value to student voice, eliciting the tacit knowledge of students and situated learning

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Innovation education in the curriculum

- Information and Technology Education curriculum in 1999
- As a multidisciplinary subject, either as an independent subject or a method to be used in or integrated into other subjects
- Innovation and practical use of knowledge
- Innovation and information technology are introduced in the same curriculum either to be used as methods or tools to change teaching or to be taught as special subjects

- The student has more control over various factors in innovation education lessons than in traditional lessons
- The role of the teacher is different from the traditional role “The role of the teacher is to be a kind of a facilitator or a guide in the solution- and production process”
Innovation education in the Science curriculum

- The discourse in the science curriculum for compulsory schools in 1999 is welcoming to innovation education
- In the categories for nature and role and methods and skills we find word as *initiative, critical thought, independence and responsibility*
- Clear emphasis on practical knowledge and skills, integration of subjects, student choice and importance of transferability of knowledge to everyday life. In other countries innovation seen as a necessary part of science education and is a formal part of the design process component of the science curriculum such as in the curriculum in Manitoba Canada.
Innovation is expected

• Innovation is expected in society, in official discourse and general discourse
• Innovation education is expected by the authorities, expressed in the curriculum

Research question:
• Where is innovation education located within science teaching in Icelandic compulsory schools?
Method

• Research on the science curriculum in Icelandic schools in the project *Intentions and reality* (IR) 2005-2007) in Icelandic schools with a grant from the Research Fund of Iceland.
  – The IR study involves 19 schools in five selected local communities with data from 105 teachers
  – undertaken by pairs of researchers including the authors, from a team of twelve, during autumn 2006 and spring 2007.
  – A mixed methods approach was used in data-gathering
    • Actual and preferred versions of school science were studied through on-line self-evaluation by teachers of science in the selected schools using a questionnaire about science on one hand and on innovation education on the other.
    • Descriptions of school science and innovation education were collected from on-site visits.
    • Transcriptions include interviews with science teachers, older learners and administrators.
    • Some classroom observations were undertaken in most schools.
    • The texts of selected written documents in the policy areas of science, technology, innovation and education from 1999 and onwards were analyzed.
Theoretical tools

• Basil Bernstein’s classification and framing
  – recognition and realization rules
  – regulative and instructional discourse

• Bronfenbrenner’s ecological approach
  – Influences from various social settings or systems: micro-, meso-, exo- and macro systems
Bernstein’s pedagogical code

• Sociological “glasses” to uncover influences in pedagogy – sensitive to context
• respect, power and responsibility

The pedagogic device with its distributive rules

• Educational practice is founded on codes of conduct and traditions
• regulates the communication it makes possible
• has internal rules that are about social order and rules of what counts as legitimate skills and knowledge.
Bernstein’s tools to detect the internal rules of the pedagogic device

- **Regulative discourse (RD)**
  - order, relation and identity
  - appropriate values for behaviour, conduct, ethics, manner, character and criteria of knowledge.
  - *This is who we are – traditions in a subject or school – this is what we emphasize – these are the kind of students we want – the culture of a subject or a school*

- **Instructional discourse (ID)**
  - competences relative to a given discipline
  - Who controls
  - Selection, sequence, pacing and criteria of knowledge
  - *These are the kind of skills and knowledge our students should acquire – that is the way we arrange teaching to get this knowledge and skills across – in this order/sequence and this is how we evaluate the knowledge and skills.*

- **RD is the dominant discourse** and produces *the order* in the ID
Bernstein’s concepts

• **Classification** – strong or weak
  – define the construction of a social space (i.e. school subjects)

• **Framing** – strong or weak
  – Who controls: the selection of communication, sequencing, pacing, the criteria and control over the social space.

• **Recognition rules**
  – understanding of “the rules of the game” – understand what is expected of you

• **Realisation rules**
  – The ability to realise the necessary skills to produce the legitimate communication - to behave, write or speak correctly in a given context
Framing is strong when the teacher has explicit control e.g. the pedagogic practice is visible, weak framing gives the student more control and tend to have invisible pedagogic practice.
Results

• Classroom observations, interviews with students and science teachers showed
  – innovation education is uncommon in these schools in general and in science lessons.
• Principals (interviews)
  – usually positive towards innovation education or neutral
  – many do not see it as a special task that needs attending.
• Science teachers (interviews)
  – positive towards experiments and field work, but find they are pressed for time to cover
    the teaching materials and prepare students for national exams
• The teachers’ answers to the questionnaire on innovation education
  – 60 of 105 teachers knew enough about IE to answer the IE questionnare
  – wish for a better status of the subject and that it has generally a low profile in the
    schools.
• The students in the interviews
  – wish for more experiments and field work in science
Innovation education is uncommon

• One of the schools currently offers innovation education as a special subject for one age group (level 5).
• It was usually acknowledged that teachers knew little about innovation education with a few exceptions.
• In some cases the methodology of innovation education was detected in the school work, without the teachers knowing that they were acting in the innovation education spirit.
• Innovation education was traced back some years in one school as an independent subject, but had disappeared as it required extra time and additional resources.
• Within science lessons innovation education is rarely used but was detected in few incidents.
Conclusions

The discourse of innovation education is hesitant, limited and vague or non-existent in science teaching at the compulsory level.

**Personal level:** In IE the students are given more autonomy than in traditional subjects where the teacher usually has clear power and control. IE has a weak framing that requires different recognition rules and realization rules of both teachers and students.

**Microsystem:** IE has a weak classification as it can be integrated into any subject and can integrate almost any subject.

**Mesosystem:** The regulative discourse at the school level has the better of the external supportive discourse of innovation. The discourse of the school demands conduct and manner and criteria of knowledge that are often in opposition with innovation education.

**Exosystem:** The translation of the regulative discourse into schools does not manage to create a holistic IE instructional discourse in action.

**Macrosystem** The regulative discourse towards innovation education seems on the surface to be supportive, expects innovation in society and praises it as a valuable source of wealth and improvement in science and living.

Integration of the external and school regulative discourses are needed. The external discourse shows what is wanted but does not help schools with bringing innovation education into science lessons.
Implications

• To integrate these discourses in school practice, a mixed pedagogic practice (Morais, 2002) of weak and strong classification and framing may be needed to open up the possibilities of using innovation education in science.

• The teachers and students must acquire recognition and realization rules that make the activity of innovation education in science worthwhile.

• The students in the research long for more hands-on experience in science and the teachers admit the importance of such work but the regulative discourse of the national exams and for covering the “material” translates into an instructional discourse that has the opposite effects, a discourse of academic emphasis and strong classification and framing
  – The foundation of such a change to use IE resolutely in science must be to introduce innovation education to science teacher students, in-service teachers and administrators in Icelandic schools so teachers can acquire the recognition and realization rules necessary for implementation within a somewhat firm regulative discourse.