Interdisciplinary teaching in Swedish primary schools: Teachers’ perspectives of subject-matter integration in technology and history

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ABSTRACT

Technology is a compulsory subject for all school years in Sweden. The curriculum states that teaching should contribute to the students' understanding of technological development (LGr11, syllabus in technology). Interdisciplinary teaching is encouraged in the curriculum, however, the relationship between subject-matter in technology and history is not well documented. In this study, five primary school teachers’ experiences and attitudes of interdisciplinary teaching are investigated through open-ended interviews. A thematic analysis of the data identified three preliminary themes. The first theme confirms that interdisciplinary teaching occurs. The teachers say that through interdisciplinary teaching, they build meaningfulness and coherence for students. In the second theme, teaching on technological development often emerges as spontaneous and unplanned. Here, teachers became aware in the interview that their teaching may also be described as technological. The third theme suggested that teachers used artefacts as an entrance to the past, for student’s immersion and understanding. The interdisciplinary teaching between technology and history is largely unexplored, especially for the younger ages. Through identifying that in teaching practice technology is integrated with history, although not always planned or consciously, the technology subject can gain more awareness and a stronger position in the curriculum and wider contexts.

Key words: Interdisciplinary teaching, Technology Education, Technology and History, Teachers’ perspectives, Swedish primary schools.

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INTRODUCTION

According to overall goals and guidelines in the Swedish curriculum it is stated that the teachers should - among many requirements - give students the opportunity to work "interdisciplinary" (Skolverket, 2011a /16, chapter 2, p14). Even so, the National curriculum (ref Skolverket 2011a/16) is divided into subjects, for example mathematics, Swedish, history and technology, each subject has an independent syllabus.
This study investigates how five primary school teachers in Swedish schools express how they integrate technology and history subjects. Our interest is how the teachers describe their practice of interdisciplinary teaching in relation to the curriculum and other factors. With interdisciplinary teaching, we mean that they during the same lesson address core content and/or purposes from more than one subject. The development of the school subjects is closely linked to social development and different knowledge and science ideals (Linde, 2012; Lindquist, 1987). In the Swedish curriculum debate, a progressive thinking tradition has been influenced and linked to thematic interaction and a holistic view. However, there are contradictions in the approach and different ways to handle content (Linde, 2012). Bernstein talks about two different codes for the organization of subjects in curriculum theory (Bernstein, 1971, Linde, 2012). With "collection code" Bernstein suggest that the subjects are defined according to the academic disciplines. The teachers in that code identify themselves as subject representatives. "Integrative code" means that there are other entitites than the subject that are cohesive, for example the class, the team, or overall themes. The studies are thematic and the teachers cooperate. The teachers within that code identify themselves more as educators than as a representatives of a discipline.

Interdisciplinary teaching has long been discussed in Sweden (Svingby, 1986). Internationally, variations of integrative, holistic, or interdisciplinary curricula have been used and discussed (Vars, 1991; Lenoir, 2006). Interdisciplinary teaching in science, technology, engineering and mathematics subjects (so called STEM) has been well researched both nationally and internationally (cf. Persson, et al, 2009). An interventional study from the United States has shown, that it benefits students' interest in these subjects, but also that it is a challenge to get teachers to adopt this approach. (Al Salami, et al., 2017). In a British project it is investigated how teachers of middle school students worked with the topic “Mountains on the moon”. Here the students learn about the development of the telescope, and how the mountains of the moon could be discovered (Solomon, J.et al., 1992).

The literature addresses interdisciplinary teaching primarily concerning older students, in terms of case studies or problem solving where social science plays an important role (Eg. Blanck 2014). Similarly Bosser (2018) studies the teaching of natural science based on social issues. Examples of interdisciplinary teaching can be found in Common Core Era. This is an American initiative on common subject core in mathematics and English to raise student results and initiate critical thinking among students. In that effort, many teachers seem to combine project-based interdisciplinary learning with new technology. Here, all kinds of subjects take place, eg. in the Igarden project, where the teacher combines social studies, language arts, mathematics, and science together in a hands-on, inquiry-based unit. (Cavin, et al. 2014). Linked to the subject technology, we find, for example, a development project from the 1960s where technology (in terms of technical orientation) is tested as it was considered particularly suitable for resolving boundaries between subjects (Hultén, 2011). In design some projects are described with an interdisciplinary character, but also mostly for pupils in their teens. For younger students there are interdisciplinary project with physical activities often involved (e.g. Gortmaker et al. 1999). As regards the younger students, the integration of some subjects seems to be more explored than others. For example, a lot of teacher students write about how mathematics is managed trans-disciplinarily (e.g. Johansson et al. 2006).

The present study has a focus which, according to this first examination, is unexplored. Neither technology for the youngest students nor technology in social study subjects is well documented. This study can contribute and open up for further issues.

The aim of the study is to broaden, develop and strengthen the teaching of technology and technology-historical approaches. Our interests have been to investigate the different experiences and attitudes the respondents express in terms of interdisciplinary teaching of technology and history. Our research questions are:

- What is expressed by teachers about their interdisciplinary teaching between the subject of technology and other subjects?
- What do the teachers express about their teaching that deals with technological development?

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1 Science, Technology, Engineering, Mathematics
THE SWEDISH CURRICULUM

To understand how Swedish schools are organized in school subjects and their relation to each other, here follows a brief description of the Swedish curriculum (Skolverket 2011a/2016). Chapters 1 and 2 deal with value bases and overall goals and guidelines. There we find the above-mentioned use of the term "interdisciplinary" as guidelines for teachers and principals, but also the requirement to provide students with an overview and context, which can be interpreted to work towards subject-based approaches. The third part of the curriculum is the syllabus. Each subject is described in three parts. The first part consists of a target text for each subject. There it formulates the subject-specific overall purpose of the study of the subject in elementary school.

The central content is different from higher stages in that here all the elements in the social study subjects (called SO) are presented in a single block. This also applies to natural science studies (called NO). Technology is written independently. It has its own purpose, such as all subjects, but also its own central content for all grades. We find here that interdisciplinary teaching may seem to be mainly mandated between the SO subjects and between the NO subjects at the elementary level through the co-written subjects contents. But also in the subject of technology, an interdisciplinary approach is offered. "Technology and technological change" is the subject of a school's in-depth subject didactic texts on the central content of technology (Skolverket, n.d.). It emphasizes that the important purpose of technology education is contributing to the students' understanding of how technology evolves over time and how this development can be explained. Many examples from history are given. However, no subject description or interdisciplinary teaching is mentioned or problematized.

There are difficulties in this expression form. The idea that integrated education is teaching activities where subject boundaries are insignificant, while the requirements are for teachers to assess the goals in for the groups of subjects SO and NO. We see the potential of investigating the presence of relationships between subjects that teachers practice to create understanding and comprehension. Our area of interest lies in investigating the existence of interdisciplinary teaching between history, a subject belonging to the SO block, and the independently written technology subject.

METHOD

The study is based on a socio-cultural learning perspective, as we see the teachers' statements based on their socio-cultural experiences in the time and environment they live and work (eg Säljö 2014). Our understanding-based approach has implicated a qualitative interview study. Four informants have been interviewed through the internet media Skype. This has enabled a geographically wider selection of respondents. The fifth person was interviewed face-to-face. The interviews were semi structured (Robson & McCartan, 2016). The informants are active teachers who teach grades 1 through 3, at elementary school, except for "Anna" who were retired. The selection of respondents is a convenience choice (appeal through social media), in addition to the choice of Anna, who is strategically chosen to represent a previous approach. The selection is not representative but gives a variety of differences and similarities. The selection and the possible option of general reasoning conclusions will be discussed in future study.

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2 The subjects are religion, social sciences, history and geography
3 The subjects are physics, chemistry and biology
Table 1: List of respondents, the names are fictitious:

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Teacher education / Ed. in technology</th>
<th>Teacher experience years at interview;</th>
<th>School location, organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eva</td>
<td>Grade 1-7/ for grades 1-3.</td>
<td>5 y.</td>
<td>Urban, independent school</td>
</tr>
<tr>
<td>Sanna</td>
<td>Grade 1-7/ for grades 1-3</td>
<td>2 y.</td>
<td>Same as above</td>
</tr>
<tr>
<td>Pia</td>
<td>Grade 1-7, sw.; soc.science/ No tech. education</td>
<td>13 y.</td>
<td>Small town, central Sweden, municipal administration</td>
</tr>
<tr>
<td>Jeanette</td>
<td>Grades1-7, math, science, tech./ grades 1-7</td>
<td>5y.</td>
<td>Small town, southern Sweden, municipal administration</td>
</tr>
<tr>
<td>Anna</td>
<td>Primary school teacher/ shorter further grades 1-3</td>
<td>43 y.</td>
<td>Inner city school, metropolitan area, municipal administration</td>
</tr>
</tbody>
</table>

The documentation consists of audio recordings that have been transcribed in somewhat edited form. The analysis has been inspired by Grounded Theory approach. (e.g. Hallström et al., 2014). According to Robson & McCartan (2016), grounded theory has three stages, which can serve as a basis for explaining the stage at which this study is located. First, the researcher finds conceptual categories in the data, then searches relationships between these categories. Subsequently, core concepts arise, in which the material is brought together and described for relationships between core concepts and other research. In the analysis work, three preliminary core concepts emerged: Interdisciplinary teaching in practice, Technology development is spontaneously addressed as well as Artefacts as an entrance to history awareness.

RESULTS

Interdisciplinary teaching in practice

The teachers all confirmed the interdisciplinary teaching. With interdisciplinary teaching, we mean that during the same lesson they address central content and/or purposes from more than one subject. The interviews initially asked for integration with other subjects, after which the questions were addressed to integration into social subject science (SO subjects) and history. The results show that the integration between technology and natural science subjects (NO subjects) is considered natural, by some. That connection is more conscious and clear: Eva explains that it depends on how the subjects were handled in her education:

"associated with NO, because of how it is presented at the university. And read together, becomes a natural link." (EVA?)

"The first things you associate, naturally." (Jeanette)

NO is considered to be more naturally linked to the subject of technology by Eva, Sanna and Jeanette. These three have a more recent teacher education degree, so that indicate the relevance in Eva’s explanation about the
impact in her the education. Eva believes that the nature-oriented subjects have a more systematic approach, which she feels is easier to use with the students. This way is to present hypotheses, and work chronologically. Eva also applies this systematic approach in other subjects, such as Reading comprehension. Thus, it is the system of NO that is applied rather than the subject content. Pia, in contrast, is opposed to the connection between NO and technology. Pia has an older education, more specialized towards Swedish and social study subjects. She thinks the technology does not need to belong to NO block. She brings up the Everyday technology she has taught the class, about swinging boards and traffic, and how traffic rules have been adapted based on technological changes. For her the integration of technology with SO is equally natural to that with NO.

In further discussions we understand that the division into school subjects does not seem to be the primary division. A teacher believes that it is important to teach one thing at a time, but not necessarily one subject at a time. They see no purpose to distinguish and name the subjects for the students. Anna and Pia says:

"They /children/ do not think that way, or I do not think that way .."(Anna)
"try to bake together, I think, in larger themes". (Pia)

Jeanette thinks it is good to point out that what has been taught is technology, because:

"it is useful to say, so as not to be afraid /of the subject/ when they grow older, they are good".

She thinks she counteracts that students think that technology is difficult by naming it. Students get the opportunity to discover that they are knowledgeable in the subject.

Teachers believe that they build meaningfulness and coherence by integrating subjects. Sometimes they separate and clarify the school subjects for the students, but this is done during another lesson, aimed to process and clarify the knowledge requirements. This is also done by the teacher in assessments, or when they document the teaching.

Afterwards, when I assess the activity or when I write down a bit of what we learned and what we were talking about, then I try to be aware that it became technology and documented it in a way. (Pia)

Here, Pia also raises another subject we have discerned, how the purpose and central content of the technology syllabus can be spontaneous and unplanned in teaching.

**Technology development is spontaneously addressed**

The teachers tell how they can come up with technological development in the classroom, often by chance or because students' questions guide them. Teachers use expressions that make us understand that they end up in the history of technology or technological development without having planned it in advance. For example:

"Slips in, gets over, gets quite aware ...")(Sanna)

"I do, though, but not really planned. That’s the crazy thing about it, that it comes spontaneously. "(Pia).

"I try to be aware of it in retrospect and documenting in some way." (Eva)

Pia further says that when she is in another, she usually takes care of lifting as the children think is exciting. She lifted the example of the theme “The farm”(NO). She argues that it became a lot of history, how farms were managed in the old days (HI).

.. and it is technology, usually it comes in technology, also for that part /.../in the context, get inspiration, when in other words when comparing spontaneously, shows up, the technology... (Pia)

The teachers are guided into technology for example by the children's questions about artefacts from the teacher's childhood. Also in learning activities they slide into teaching about a historical object and compare it with the present.
Artefacts as an entrance to history awareness

"...showing typical things for each era, you have to look at how they lived, and that includes technological development."

(Eva)

Eva expresses how she emphasizes the way the objects become an entrance to historical consciousness. She describes how she sees things as part of technological development and this as a part of the knowledge of how they lived their everyday life.

The teachers' use of artefacts can be seen as an entrance to the past. The term "typical things" implies that Eva discerns key objects that can be used to clarify. Sanna exemplifies with the wheels, and then says in the same sentence "how you travelled". She connects the artefact’s function, as an explanation for why she specifies a precise object. It seems that the artefact is usually mentioned only once a sociotechnical context has already been defined. But sometimes the function is mentioned first. When Anna described her theme "How did we get fire?" she first talked about tinder and "a fire-bow". The students got to try this technology. The purpose of letting students try ancient technology appears to be creating immersion and understanding. A teacher says that the students then

"notice that it is not so terribly easy". (Pia)

The question is whether artefacts is a goal or a mean, requires deeper analysis.

DISCUSSION

This study investigates how primary school teachers express how they teach interdisciplinary - during the same lesson occasion, central content and /or purposes deal with more than one subject of study, of which the subject is one. In their response we have so far found three interesting themes.

The first is that these teachers confirm that interdisciplinary teaching occurs. They describe their teaching primarily by talking about themes, where school subjects are integrated, meaning they build meaningfulness and understanding of the whole. In another kind of lesson they separate and clarify the school subjects for the students. This is done for documentation and assessment according to the knowledge requirements.

Here we see how the teachers balance the contradiction between, in one hand, following curriculum recommendations in Chapters 1 and 2 in the Swedish national curriculum (Skolverket (2011a/2016). 2011) in terms of "interdisciplinary" and the requirement to provide students with an overview and context. On the other hand these teachers are trying to fulfil the requirements to assess the goals in the individual subjects, that are expressed in the central contexts and the knowledge standards in the curriculum.

One way of explaining that primary school teachers integrate subjects can be to use terminology from curriculum theory. Bernstein (1971) referred to two different codes in curriculum theory. In the "collection code", the subjects correspondents to the academic disciplines. With "integrative code" the importance are other entireties, e.g. overall themes. The attitudes of the interviewed teachers, the organization of the elementary school, and subjects presented in a single block in the curriculum indicate that the teachers can be considered to include "integrative code".

In the second theme, teaching on technological development emerges as unplanned. To some extent, this is an interview effect. The teachers become aware in the interview situation that the examples they describe can also be seen as teaching in technology. They can afterwards relate their teaching to some of the central content from the curriculum, and as researchers we can relate their activities to the purposes of the subject. Now it becomes interesting to discuss the definitions of technology. Are the curriculum unclear in relation to how technology occurs in different contexts? Does it depend on who you are and what education do you have how to define technology? Are there different views on how contextual technology should be considered as technology education? This is interesting to further explore in future studies. Another interview effect was also the spontaneous expression of bad conscience that the interview questions gave rise to, which may confirm Swedish School Inspectorate report (?). Several of the teachers expressed that they have taught too little technology, it had become "too little construction"(Sanna). This is also related to the discussion of the definition of technology, as a subject where you contract things.
The third theme suggests that teachers use artefacts for immersion and understanding. Are there recurring key objects? Is there a kind of canon of meaning-bearing and knowledge-bearing objects, which many teachers return to when teaching the story of "the old days"? These are questions we take with us into the next phase of the project, which is a classroom study. After this study on the teachers' intentions, we will explore how interdisciplinary teaching in history and technological development is appearing and manifested in practice, by classroom observations. Already we have noticed the teachers use of artefacts as carriers of knowledge, this is an interesting path for the future study.

In the study we have examined five teachers' statements about the occurrence of technology in history. That particular connection is largely unexplored, especially for the younger ages. By demonstrating that technology is taught integrated with history, sometimes even unplanned and subconsciously, the technology subject can be given a stronger position in a wider context.

REFERENCES


