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# WHAT IS “STRONG PRESENCE” OF A MESSAGE IN A STEERING DOCUMENT?

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*The aim of this paper is to discuss what a “strong presence” of a message in a syllabus could be. The discussion takes a starting point in what we call the reform message; that what mathematics is can not only be described in terms of content and procedures, but must also be defined in terms of competencies, e.g. problem solving, reasoning and communication. The analyzed document is the Swedish syllabus for the first course at upper secondary school. Different ways, both quantitative and qualitative, of determining what a strong presence of a message could be are presented and discussed.*

Keywords: Competencies, strong presence, curricular documents.

## INTRODUCTION

In 1994, a new type of content was introduced in the curricular documents in Sweden. Lundgren (1999) describes the goals that now appeared as "expressed less in terms of content and more in terms of concepts, connections and knowledge as instruments for learning" (p 39). The message was that it is not enough to describe the goals of mathematics education *only* as content (e.g. arithmetic and geometry), it is also necessary to formulate process goals or competence goals (e.g. to be able to reason mathematically or to solve mathematical problems). Some examples of competency goals (especially problem solving) were present in earlier versions of the mathematics syllabuses, but in 1994 they were given much more central roles. Therefore, this change can be regarded as one of the larger school reforms ever initiated in Sweden.

The Swedish national curriculum in mathematics was inspired by (among other things) several NCTM documents according to The Swedish National Agency for Education (1997). The NCTM Standards (2000) is one international example of a well-founded and research-based reform framework describing competency goals (although denoted process goals). There are several other frameworks that build on the idea to complement content goals with competency goals; e.g. the KOM-project (Niss and Jensen, 2002; Niss 2003) and ‘Adding it up’ (Kilpatrick, Swafford and Findell, 2001). The large international comparative studies TIMSS and PISA also have their own frameworks for this type of goal descriptions (Mullis, et al., 2003; OECD, 1999).

The work presented in this paper is part of a comprehensive project that aims at clarifying the role of the national tests as catalysts in the implementation of the competency reform in Sweden. In the comprehensive project we analyze, among several other aspects, teachers’ interpretation and use of syllabuses, and how this might

be connected to a conceptual change concerning the reform message. In Sweden, the syllabus is the legal document that is supposed to guide the teachers' work. However, the Swedish syllabus is written in a very compressed way. Even if concepts like problem solving and reasoning can be found, they are not defined. Based on this, one important aspect to consider is how the reform message is conveyed in the syllabus and one large research question is: *In what ways, and how strongly, is the reform message present in the national syllabuses for mathematics in Sweden?*

The aim of this particular paper is therefore to discuss what method to use in order to answer this research question, i.e. to discuss what *strong presence* of the reform message in a mathematics syllabus could be.

What does it mean that a competency goal has a strong presence in a document? That it is mentioned many times? That it is easy to understand and use? That it is emphasized in the text? What type of aspects are relevant when it comes to determining if the reform message is strongly present in the curriculum?

We will mainly discuss two possible ways of determining strong presence:

- Quantitatively: the amount of indications of the reform message, especially in relation to the traditional way of describing mathematics (content and procedures).
- Qualitatively: how clearly the message is presented and whether it is emphasized or not.

This paper will first present the theoretical aspects of the analysis of the syllabus, i.e. how to identify competencies. We will also show some examples of results and discuss possible interpretations.

## **THEORETICAL FRAMEWORK**

In this study we have used a research framework (Lithner et al., 2010) to analyze to what extent and in what ways, and especially how strongly, competency goals are present in a mathematics syllabus.

Here follows a short description of the six competencies defined in the framework. For more detailed definitions and thorough descriptions, see Lithner et al (2010). The competencies are:

- Problem solving ability. Here problem solving is defined in the same way as in the NCTM Standards: “engaging in a task for which the solution method is not known in advance” (NCTM, 2000, p.51).
- Reasoning ability. The explicit act of justifying choices and conclusions by mathematical arguments.
- Representation ability. Mathematics is built on abstractions of concepts, and the competence is to be able to use, interpret and create representations of these abstractions.

- Connection ability. To identify, create, and use connections between mathematical entities or representations.
- Communication ability. To engage in a process where information is exchanged between individuals through a common system of symbols, signs or behavior.
- Applying procedures ability. To handle mathematical procedures, i.e. to carry out a sequence of mathematical actions in order to solve a task.

In this research framework the competencies are more clearly defined than in many other frameworks, mainly due to the fact that the purpose of these other frameworks (e.g. NCTM Standards (NCTM 2000) and the KOM-project (Niss & Jensen 2002; Niss 2003)) is to communicate the competence message, not to function as a research tool.

This report will discuss the presence of what we call *the reform message*, which consists of the first five competencies in the list above, and especially how strong this presence is in a syllabus. The last competency, the applying procedures ability, will together with content goals (e.g. geometry and statistics) in the syllabus be called the *traditional message* of mathematical goals. It is well known that mathematical goals historically have been expressed mainly as content and as methods and procedures to use on this content. Therefore the *traditional message* will be used in order to contrast the *reform message*.

## **METHOD**

We have used content analysis (Krippendorff, 2004), described below, in the analysis of the course syllabus for Mathematics, course A, which is compulsory for all students during the first year in upper secondary school in Sweden (Skolverket, 2000).

### **Content analysis**

Content analysis is performed through the application of a coding tool, or a codebook, that specifies the recording units that are of interest in the analysis (i.e. the competences). The recording units may be particular words, metaphors, themes, types of arguments, or anything else possible to discern within the text. The codebook also includes a code for each recording unit and coding instructions describing how to handle more doubtful cases. The text is then split into units of description (e.g. sentences, clauses and subordinate clauses) that are coded separately. The act of coding means that the presence of any recording unit within a unit of description is noted using the predetermined codes and recorded in a prepared schema.

In order to make the analysis consistent we used double coding in parts of the text, i.e. two researchers carried out the analysis and the results were compared. There is a risk of systematic drifts in this type of analysis, meaning that the researcher's demands for a specific coding are changing during the work. We tried to avoid this by

carefully comparing parts of the analysis from the beginning of the process to parts from later stages in the process.

### ***Units of description***

Krippendorff (2004) defines the units of description as “the smallest units that bear all the information needed in the analysis” (p. 100) and notes that the boundaries between units can be motivated by physical or statistical traits, but also by syntactical, categorical, propositional, or thematical distinctions. A unit of description is therefore here defined as the smallest parts of a sentence that carry meaningful information.

Here follow two authentic examples from the creation of units of description out of the syllabus (Skolverket, 2000).

Example 1. The sentence “Mathematics is an important part of our culture and the instruction shall give the student knowledge of the subject’s historical development, importance, and role in our society.” Is divided into four units:

- a. “Mathematics is an important part of our culture and”
- b. “the instruction shall give the student knowledge of the subject’s historical development”
- c. “the instruction shall give the student knowledge of the subject’s importance”
- d. “the instruction shall give the student knowledge of the subject’s role in our society.”

Example 2. The sentence “Pupils analyze and interpret the results from different kinds of mathematical reasoning and problem solving.” Is divided into four units:

- a. “Pupils analyze the results from different kinds of mathematical reasoning”
- b. “Pupils interpret the results from different kinds of mathematical reasoning”
- c. “Pupils analyze the results from different kinds of problem solving”
- d. “Pupils interpret the results from different kinds of problem solving.”

### ***Recording units***

The six basic recording units are the six competences described above: Problem solving ability, Applying procedures ability, Reasoning ability, Representation ability, Connections ability, and Communication ability.

We have also marked a number of secondary recording units. Three of these, content goals, concepts and understanding (also conceptual understanding) we knew in advance that they would appear (from our earlier experiences of the syllabus), so these were used as secondary recording units. We also found several other secondary units, e.g. mathematics in everyday life and affective goals, but since they are not central for the main discussion of this paper, these results will not be further discussed here.

## ***Coding***

The coding was carried out in a spread-sheet document (about 400 rows and 30 columns) where one unit of description was put on each row and then marked with presence of the six competences, content goals, and other secondary recording units. Statistical data was then collected for each competence, and also for each part of the syllabus.

The first example above was marked as secondary recording units, and the second as *reasoning* and *problem solving* respectively (i.e. the reform message).

## **Quantitative analysis**

The analyzed syllabus consists of five parts: The aim of the subject, Goals to aim for, Structure and nature of the subject, Goals, and Grading criteria. The whole text was divided into units of descriptions and coded according to the process described above.

The number of units of descriptions indicating any of the competencies (except the applying procedures ability) were counted, as was the number of units indicating the traditional message (applying procedures and content). The number and percentage of indications of both messages were compared for each part and the whole of the syllabus.

## **Qualitative analysis**

In order to find answers to the question concerning how clearly the message is conveyed, we used the word list for each competence. The definition of each word or notion was retrieved from three different language resources. In this study a word or notion is seen as clearly conveyed (understandable) if it either is defined in the text or if the definitions in the three resources coincide. The resources used were The Swedish Academy Dictionary, the Swedish National Encyclopedia, and the Swedish Wikipedia, all three resources available on the Internet<sup>1</sup>. We also looked at how the notions or words were used in combination in sentences and expressions. Could different meanings come from how the sentences were combined?

The second part of the qualitative analysis concerned whether the reform message was emphasized in any way, if there were sentences or units of descriptions where clear indications of emphasis could be found. The following invented example could be such an emphasis: “problem solving is a very important aspect of mathematics”.

## **RESULTS AND DISCUSSION**

Three aspects of the analysis will be presented here. First, the quantitative results and possible conclusions based on them. Second, the qualitative results and possible con-

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<sup>1</sup> The Swedish Academy Dictionary, <http://g3.spraakdata.gu.se/saob/>, The Swedish National Encyclopedia, [www.ne.se](http://www.ne.se), and the Swedish Wikipedia, [www.wikipedia.se](http://www.wikipedia.se).

clusions. Third, a discussion about how to interpret these results and what *strong presence* of the reform message in a mathematics syllabus could be.

### **Quantitative results**

The syllabus consists in total of 1725 words. The text was divided into 329 units of description. More than half of these units contained indications related to the reform message (193 units, 59 %). Higher values were found in some parts of the syllabus, e.g. the *Grading criteria* (83 %), and lower values in other parts, e.g. the *Aim of the subject* (38 %). A possible conclusion is that since the reform message is indicated in more than half of the units, there is a strong presence of this message.

#### *Comparison of number of indications*

90 units of description contained indications of the traditional message (27 %). Due to some overlap of the two types, 244 units of description contained indications on one of the two types or both. Indications on the traditional message were found primarily in the *Goals* section (44 units, 45 % in that section) and in the section *Structure and nature of the subject* (30 units, 33 %).

When the number of indications of the reform message is compared to the number of indications of the traditional message we see that there is approximately 100 more indications of the reform message in the text (193 vs. 90). The indications of both messages were not evenly distributed over the different parts of the syllabus. It was even the case that in one part there were more indications of the traditional message (i.e. in the section *Structure and nature of the subject*, 19 vs. 30). To summarize; as a whole there are a lot more indications of the reform message than of the traditional message, but that in some sections the traditional message is more prominent. A possible conclusion is that the reform message is strongly present.

#### *Comparison of quotient of indications*

The quotient between the number of indications of the reform message and the number of indications of the traditional message varies throughout the syllabus. In total, the quotient between the number of indications of the reform message and the traditional message is 2.14 (i.e.  $193/90$ ). In the section *Structure and nature of the subject* the quotient was 0.63 and in the *grading criteria* it was 6.91. This comparison also suggests that the reform message is strongly present in the syllabus as a whole.

### **Qualitative results**

#### *Clarity*

The analysis found no instances in the syllabus where the meaning of a notion or a word was defined. When we examined the definitions of the notions in the three external resources (see Section Qualitative analysis), we found several differences, one concerning the central concept 'problem'. The Swedish Academy dictionary defines a problem as “a task to be solved” and the Swedish National Encyclopedia as “a difficulty that demands an effort to deal with”. Wikipedia gives the information that the word 'problem' has multiple meanings. The two notions problem and problem solving

can be found in 24 % of all units of description which means that a quarter of the units contains a central concept that is not clear.

Another example is the word 'reasoning' that was clearly defined by the language resources, but in the syllabus it was found both standing alone and in combination with several other words (i.e. logical reasoning, mathematical reasoning, and geometrical reasoning). There are no explanations of the differences (if any) between the concepts, e.g. between reasoning and logical reasoning, and the interpretations of the concepts are left to the reader. Our conclusion is that the message is in general not presented clearly in the syllabus.

### *Emphasis*

Concerning whether the message is emphasized, the analysis resulted in two relevant instances. One of these was: "Problem solving, communication, using mathematical models, and the history of mathematical ideas, are four important aspects of the subject that permeate all teaching." The use of the word *important* and the instruction that the aspects should *permeate all teaching* leads us to conclude that the sentence is an emphasis of the reform message. The other situation was of the same kind and both sentences are part of the section *Structure and nature of the subject*. Since the syllabus consists of five pages (1725 words) this can be regarded as rare occurrences. Our conclusion is that the reform message is not emphasized throughout the syllabus.

### **Discussion of strong presence**

The aim of this paper is to discuss what *strong presence* of the reform message in a mathematics syllabus could be. We have examined what the results would be if we use quantitative measures as well as qualitative measures. On the one hand, it is possible to draw the conclusion that the reform message has a strong presence in the syllabus since there is a large amount of indications, both in numbers and in relation to the traditional message. On the other hand, the conclusion that the reform message has a weak presence is also reasonable, since our qualitative analyses show that the reform message is not presented clearly and is not emphasized through the syllabus.

The conclusion concerning whether there is a strong presence or not therefore depends on the method we use to measure it, which makes purpose of this paper relevant and important. The next step is then to decide what type of presence that is meaningful for our particular situation and purpose.

### *Challenge for change*

The aim of the comprehensive project, as mentioned in the introduction, is to clarify the role of the national tests as catalysts in the implementation of the competency reform in Sweden. A central aspect in this work is teachers' interpretation and use of the syllabuses, and how this might be connected to a conceptual change concerning the reform message. According to the framework for conceptual change that is used (Gregoire, 2003) it is necessary for a message to challenge a recipient in order to initiate a systematic processing of the message that leads to a true conceptual change. If



the message is not seen as a challenge, recipients tend to do only heuristic processing which leads to no or superficial change.

So what is necessary in order to challenge the teachers? They probably have to *notice* that there is something new in the syllabus. This is to some extent connected to quantity; the message **is** there. But can they still miss the point? And even if they notice it, will they be challenged?

One possibility is that the message is challenging *because* it is unclear, for example if it leaves the reader with a feeling of confusion. One other possibility is that an unclear message can be interpreted anyway the reader wants, which could lead the teacher to simply assimilate the message without any systematic processing (and without any feeling of challenge).

An important issue is whether the traditional message is clearer than the reform message, since there are no explanations of the concepts connected to traditional mathematical content either. Well, firstly, the traditional mathematics content is older and more established, there is little discussion on what e.g. addition is. Secondly, textbooks explain and present examples of mathematical content concepts. In the comprehensive project we also find that the textbook exercises to a larger extent allow the students to practice algorithms and procedures than the reform-oriented processes (e.g. problem solving and communication). It is also possible to argue that a new message needs to be explained more clearly than an old one, just because it is new, and especially if it is meant to trigger off change.

Another possible reason that the teachers might not get, or are not challenged by, the message is that they might not read all parts of the syllabus to the same extent. The result of the analysis showed that the reform message is present to different extent in different parts of the syllabus. Data from the comprehensive project indicate (but is not fully analyzed yet) that teachers tend to focus on the Goals section. If this is the case, they mainly read a section in which both messages have about the same amount of indications. Also, there is no emphasis of either message in the Goals section. This could be interpreted as that even though the reform message has a strong presence in the syllabus, the teachers focus on parts of the syllabus where the message has a weak presence.

To summarize, we have not yet decided fully on how to interpret the results from this analysis. We will therefore continue to develop both our methods and our arguments.

### **Future possibilities**

*Looking at other qualitative aspects we haven't analyzed.*

We have looked at two qualitative aspects, how *clear* a message is and to what extent it is *emphasized*. Are there other important aspects we have missed?

*Looking at syllabuses in other countries.*

In order to determine important aspects of the syllabus one possibility is to examine how the reform message is presented in other countries' syllabuses.

*Looking at older versions of the Swedish syllabus.*

In the 1980 version of the syllabus, the only competence related goal that was present was problem solving, and this was mainly discussed as an activity. A more thorough analysis might help us understand how the message was introduced and how challenging it might, or might not, have been.

*Looking at how teachers in Sweden perceive the learning goals in the syllabus.*

It might not be possible to find out if a message has a strong presence without taking a reader into account since a text always has to be interpreted. We have indications from another part of the comprehensive project concerning how teacher interpret the syllabus, a subject for another study.

*Looking at other messages in the syllabus.*

We focus here on the five competencies in the framework by Lithner et al (2010). There are of course a possibility that other messages are more strongly conveyed or emphasized in the syllabus, e.g. affective goals or goals concerning the use of mathematics in every-day life. These possibilities have not yet been analyzed in this project. There are also researchers who claim that in a curriculum, one message or another is *always* emphasized. One example is Morgan (2008), who claims that representations of the concept of economic space in school geography are never neutral, but are "based on certain ideas about spatial and social relations" (p. 333). If this is the case, it is always up to a reader to identify the ideas behind a curriculum.

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