# The National Tests and National Assessment in Sweden

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In Sweden we have no external examination when the students leave secondary or upper secondary school. On the other hand we have national tests in Mathematics both for the compulsory school and the upper secondary school. We have also had national assessment in Mathematics in grade 2 and 5 1989, in grade 5 and 9 1992, 1995 and 2003.

## National Tests

### The old system

From the middle of 1940 until the middle of 1990 the system of grades was norm-referenced in Sweden. At the beginning there were norm-referenced tests only in grade 2, 4 and 6 in the compulsory school. Later there were compulsory achievement tests in Mathematics only in school year 9 and in grade 3 for two of the course programmes in the upper secondary school. The aim of the tests was to get as large a uniformity in the teachers grading as possible across the country. The teacher should through the results of the test get information of the average level and the distribution of his class in proportion to classes across the country. The test gave information as to how many students in a class should have the different grades, but the test did not inform the teacher which student should have a special grade. These achievement tests were used for a group-referenced grading system, i.e. the knowledge of all the students in the country who belong to a special cohort and study the same course are compared with each other. In this system it was very important that the tests were objective in the sense that all teachers should assess the students' solutions in exactly the same way. The tasks of the test must have a high discrimination index and must show variations in difficulty. The result of the test was the steering factor for the teacher in the grading of the students. In the upper secondary school for example it was not allowed to give grades in a class which had a difference of 0.2 or more in the mean from the test result's mean (Ljung, 1962; Pettersson, 2003).

### The new system

A new national curriculum for compulsory school and for the upper secondary school came into effect in the autumn of 1994 (Utbildningsdepartementet, 1994). It defines the underlying values and basic objectives and guidelines of the school system. In addition, there is a nationally defined syllabus for each individual subject. The compulsory school syllabuses indicate the purpose, content and objectives for teaching in each individual subject. These are of two kinds: those which the school must pursue and those which is the duty of schools, to give all students the chance of achieving those objectives.

*Examples of goals to strive towards in the curriculum for the compulsory school*
The school should strive to ensure that all pupils

- develop a sense of curiosity and the desire to learn, develop their own individual way of learning
- develop confidence in their own ability
- learn to listen, discuss, reason and use their knowledge as a tool to
  – formulate and test assumptions as well as solve problems

  - reflect over experience and
  - critically examine and value statements and relationships
- take personal responsibility for their studies …
- develop the ability to assess their results themselves and to place their own and others assessment in relation to their own achievements and circumstances

*Examples of goals to attain in the compulsory school*
The school is responsible for ensuring that all pupils completing compulsory school
- have mastered the basic mathematical principles and can use these in everyday life
- can use information technology as a tool in their search for knowledge.

To coincide with the introduction of the new curriculum and syllabuses, a new system of grades has come into force. Under this system, grades are awarded on a three-grade scale from the eighth year of schooling onwards. The grades are Pass, Pass with distinction and Pass with special distinction. In the upper secondary school the grade Fail is added and the students in upper secondary school are graded after every course. The grading is goal-related; i.e. the grades relate student's knowledge and achievements to the goals set out in the syllabus. Only the teacher awards grades.

In the teachers' assessment of the level of the students' knowledge at the end of school year 9, teachers can call upon assistance to achieve goals in sections in each syllabus. These goals correspond to a Pass grade. For the Pass with distinction grade there are nationally agreed criteria. From July 2000 there are also national criteria for the grade Pass with special distinction. If a student fails to achieve the goals for a pass in any subject no grade is awarded in the compulsory school. In such a case the student and their guardians can ask to be issued with a written assessment which shows the student's progress in a subject.

At the end of school year 9 national tests are held in the three subjects Swedish, English and Mathematics in order to assess students' level of achievement. The tests provide support for teachers in awarding grades. The testing Mathematics for grade 9 consists of more traditional tasks and also more open ones. In one part of the test calculators are not allowed. Depending on the nature of the task some tasks are more atomistic and some are more holistic. The holistic ones are assessed with help of assessment matrixes. Often we also have an oral test for grade 9.

There are tests in the same subjects at the end of school year 5, but it is not compulsory for the municipality to use them. The main purpose of the subject test for school year 5 is not only to check that the students have reached the demands of the curriculum and syllabus. They have also a diagnostic purpose. In the test material there is also a scheme for self-assessment. The teacher is advised to integrate the subject test within the ordinary teaching. It is so suggested that both the ways in which the student has worked with the problem and the answer is taken into consideration. There are tasks, for both individual work and for group work. To help the teachers describe the mathematical knowledge of the student they could use a proposal for a Competence profile. The teacher should then consider both their assessment of the student's work on the subject test as well as their overall assessment of the student's mathematical knowledge. Our hope is that the teachers can, with the help of the profile, gain a more balanced picture of the student's knowledge in Mathematics. For the test in school year 9 there is a similar profile, but only referred to the test, a test profile (Pettersson, 1996).

There have been diagnostic materials for school year 2 in Swedish and Mathematics, and for school year 7 in Swedish, English and Mathematics since the spring 1996. The diagnostic materials in Mathematics are now revised and consist of two parts, one part for use in pre-school up to grade 6 and one part from grade 6 to grade 9. Each part consists of a scheme for analyse and diagnostic tasks. The purpose of the materials for analyse is to help teachers analyse and document the students knowledge in Mathematics. The same scheme is to be used for students in different ages. When using the scheme it will show the students development during several years. Students are allowed to express their knowledge in different ways, action, pictures, words and symbols. Three different areas are focused on the first scheme, Measuring and spatial sense, Sorting, tables and diagrams and Number sense. In the second scheme for grade 6–9 we are focusing on four areas. Measuring, spatial sense and geometrical relations, Statistics and probability, Number sense and Patterns and relations (Skolverket 2000, 2003).

In the upper secondary school we have national tests for every course, A–D. The tests are like the tests for grade 9 compulsory for those students who finished their math studies.

The overview shows the different test materials for the compulsory school and the upper secondary school in Sweden.

| | | |
|---|---|---|
| Diagnostic materials<br>Not compulsory | Pre-school up to grade 6<br><br>From grade 6 up to grade 9 | A booklet for analyse<br>A booklet with tasks<br>A booklet for analyse<br>A booklet with tasks |
| Subject test<br>Not compulsory | Grade 5 | 4–5 different parts +<br>group-works and self-assessment |
| Subject test<br>Compulsory | Grade 9 | 2–3 different parts +<br>group-works or/and oral test |
| Course test<br>Compulsory | A–D | 2–3 different parts |

The teacher should, according to the curriculum, when awarding grades make use of all available information of the student's knowledge in relation to the requirements of the syllabus and make a comprehensive assessment of the knowledge acquired. The national test is only a part of what should be assessed when evaluating student ability in one subject. It is only the ordinary teacher who marks and assesses the students' national tests.

The national test shall not steer the teachers in their grading but help them to assess if and how well the individual student has reached the goals for the subject. The starting point for the construction of a test is the view of knowledge of the curriculum and the view of the subject in the syllabus and from the criteria of the different grades (Pettersson & Kjellström, 1995). With the new test the teacher cannot decide any level for his class compared with other classes in the country. It is important to have tasks with different contents of the subject. The problems in the material should be designed in such a way that the student has the opportunity to show different competencies in Mathematics. The new national test works in a goal and

knowledge context. It has in parts other demands than that of a norm-referenced. The new national test must consist of more varying tasks and the students must have the opportunities to show their competence in different ways. Mathematical competence is so much more than merely knowing certain mathematical content and skills. It is also essential to communicate your knowledge to present Mathematics in written, oral, visual and symbolic forms. In addition it is important to use mathematical strategies, models and methods within our present knowledge and skills to create new skills and methods utilising a range of facts, concepts and processes. Making inferences and drawing conclusions is also necessary.

**Examples from the test material in the new system**

*The subject test for grade 5*

- A task: Carl bikes home from school at four o'clock. It takes about a quarter of an hour. In the evening he's going back to school because the class is having a party. The party starts at 6 o'clock. Before the class party starts, Carl has to eat dinner.
  When he comes home, his grandmother calls, who is also his neighbour. She wants him to bring in her post before he bikes over to the class party. She also wants him to take her dog for a walk, then to come in and have a chat.
  What does Carl have time to do before the party begins? Write and describe below how you have reasoned.

- Some questions from the self-assessment scheme

| How do you feel when doing the following? | Very sure | Pretty sure | Unsure | Very unsure |
|---|---|---|---|---|
| Estimating approximately how long a bus is. | | | | |
| Looking in a newspaper to see how long a TV programme is. | | | | |
| Working out $8 - \_\_\_ = 3$ | | | | |
| Working out $\frac{96}{3}$ without a calculator. | | | | |
| Working out which number is the highest – 3.8 or 3.14. | | | | |
| Working on tasks other than those you are used to. | | | | |
| Explaining to a classmate how you solved a task. | | | | |
| Working with someone else. | | | | |
| Working on your own. | | | | |

- Questions about Mathematics
  1. What do you think you are good at in mathematics?
  2. What do you think you need to practise more in mathematics*?*
  3. Give examples of one or several tasks in the test which you think were good. Explain why.
  4. When do you think you learn mathematics best?
  5. Write more about yourself and mathematics.

*Some examples from the test in grade 9*

- There are 11 people working in a company. Their monthly salaries are:

| | | | |
|---|---|---|---|
| 15 000 | 13 000 | 47 000 | 15 000 |
| 13 000 | 55 000 | 15 000 | 13 000 |
| 16 000 | 16 000 | 13 000 | |

  Work out the average and the median monthly salary. Which measurement – average or median best shows the salaries of the group?
  State the reasons for your choice and explain why you believe the other measurement is not as good.

- Perimeter
  In this task you will have to work with four different geometric figures. All figures should have a similar perimeter of 12 cm.

  You should work with the following geometric figures
  – a rectangle, where the length is twice as long as the width
  – a square
  – an equilateral triangle
  – a circle.
  You should study and compare the areas of the figures.
  What conclusions can be made?

When assessing your work, the teacher will take into account the following

- how clearly and correctly you have drawn the figures
- whether you have made the correct calculations
- how well you explain your workings and methods
- how well you have stated the reasons for your conclusions.

- Hassan says ”An increase from 40 to 80 is a 100 % increase”.
  Amir says ”Then a decrease from 80 to 40 is a 100 % decrease”.
  Who is right and who is wrong? Explain for each of these assumptions why it is right or wrong.

- You know that $x + y = 11$ and $2x – 3y = 2$.
  What is the value of $3x – 2y$ ?
- A more extensive task from the test for course A with assessment matrix

**The Inheritance**

***When assessing your work*** the teacher will take into account

- how well you present your work
- which methods you have used when you compared the different alternatives
- which conclusions you have drawn and how well you have explained why you drew them.

Robert has a wealthy aunt. She wrote this letter to Robert:

Numberville on the 6th of January 1999

Dear Robert!

Time flies and I'm getting older every day (I still feel well and fit, even though I've just had my 75th birthday, as you know).
I'm planning to give you some of my savings. I'll set aside a sum to you each year, beginning in January in the year 2000. You may choose which of the following alternatives you want me to use.

A 550 kr on the 1st of January in the year 2000 and thereafter 550 kr on the 1st of January each year and so forth.

B 1 000 kr on the 1st of January in the year 2000, 900 kr on the 1st of January in the following year, 800 kr on the 1st of January in the year after that and so forth.

C One single payment of 2 000 kr. You will receive an annual interest of 11 % from the 1st of January in the year 2000 and onwards.

This will only be the case as long as I live, of course. The money will be transferred at my passing away. I'm looking forward to hearing which of these alternatives you choose, and why.

Best wishes

Aunt Hulda

- Investigate and compare what the consequences of the different alternatives are dependent on how long Aunt Hulda lives. Suggest which alternative Robert should choose. Also motivate why you have chosen that alternative.
- Describe with words or formula the relations in alternative A between the sum Robert gets and the number of years.
- Describe with words or formula the relations in alternative C between the sum Robert gets and the number of years.

## Assessment matrix

### Problem solving capability

*Comprehension and method*
The assessment concerns: To what degree the student shows an understanding of the problem. What strategy/method the student chooses to solve the problem? To what extent the student reflects on, and analyses the chosen strategy and the result. The quality of the student's conclusions. What concepts and generalisations do the student uses?

*Accomplishment*
The assessment concerns: How complete and how well the student works through the chosen method, makes necessary calculations and motivates the working.

### Communication capability

*Mathematical language and/or representation*
The assessment concerns: How well the student uses mathematical language and representation (symbolic language, graphs, illustrations, tables and diagrams).

*Clarity of presentation*
The assessment concerns: How clear, distinct and complete the work of the student is. To what extent the solution is possible to follow.

| | Qualitative levels | | |
|---|---|---|---|
| Comprehension and method | Shows some understanding of the problem, chooses a strategy, which functions only partially. | Understands the problem almost completely, chooses a strategy which functions and shows some reflective thinking. | Understands the problem, chooses if possible a general strategy and analyses one's own solution. |
| Accomplishment | Works through only parts of the problem or shows weaknesses in procedures and methods. | Shows knowledge about methods but may make minor mistakes. | Uses relevant methods correctly. |
| Mathematical language and/or representation | Poor and occasionally wrong. | Acceptable but with some shortages. | Correct and appropriate. |
| Clarity of presentation | Possible to follow in parts or includes only parts of the problem. | Mostly clear and distinct but might be meagre. | Well structured, complete and clear. |

## Mathematics in a National Assessment in Sweden

The purpose of the national assessment in Sweden is to provide the government and parliament with as complete a picture as possible of how the school system is working. The need for assessment is becoming more apparent as the Swedish school system is decentralized and a system characterised by control through regulations is changed to a more goal-related system.

The national assessment will mean a broad and systematic collation, study and analysis of information about the state of the school system and the level of achieving these goals. A part of this assessment is to describe and analyse the students' knowledge and skills in Mathematics. The first national assessment was in the spring of 1989 (Ljung & Pettersson, 1990). The students in the national assessment are a random sample of 3 % of the Swedish students in grades 2 and 5. There were approximately 3 500 students in each grade of 2 and 5. Every student worked with around 100 tasks in problem solving, arithmetic and understanding of the numbers system. The teachers in the classes have answered a questionnaire about Mathematics and teaching Mathematics.

The assessments in 1992, 1995 and 2003 had a similar design than in grade 5 and 9 (Pettersson, 1993 a, b; Ek etc. 1997). In 2003 the assessment is a repeat from the assessment 1992. Studies on how the students' achievements have changed are therefore possible to do.

The national assessment in Mathematics is of importance both on a national and local level. Feedback from results has been delivered directly to the schools concerned, to the National Board of Education and to the Ministry of Education. The assessment will also provide a platform for future development of the curriculum, teacher training and in-service training, and also for research, debate etc. Many schools have, outside the National Assessment Programme, already used the instruments.

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