An approach to get to know the mathematical background of the students

Lisbeth Lindberg,

Göteborg University, Faculty of Education, Adult learning Unit, Sweden.

Most people have opinions about mathematics. Some people just love mathematics. Some people say that they hate mathematics. Other people do not understand why there has to be a school subject called mathematics. There are people who argue that they never in their adult life use mathematics in work or in hobbies. Anyhow, disregarding these opinions, most people seem to have a relation to mathematics.

As a mathematics teacher I want to know what my students´ feelings for and attitudes to mathematics are. In this session I will talk about and demonstrate the approach, which I have used for many years, the first time I meet my students to get this information. My students have to produce a graph where time is on the x-axis. On the y-axis they indicate positive and negative experiences from mathematics. More positive y-value means more positive experience and so forth. We can then talk about and analyze the graph of each student from different perspective in small groups. In *Lusten att lära – Med fokus på matematik* (2003) (Desire (lust) to learn, my translation) a report from the Swedish National Board of Education (Skolverket) I have found some of the criteria that we use. This paper gives some examples from authentic graphs and discusses the interpretations and analyses.

Introduction

By just asking your pupils or students to draw a graphic representation of their mathematics´ journey so far, you as a teacher can get a picture of how they perceive the subject of mathematics and the teaching/learning of mathematics.

Most people have opinions about mathematics. Some say they hate the subject or have a fear for it. Others do not understand why there has to be a school subject called mathematics. Some people state that they never in their adult life use mathematics, neither in their profession nor in their daily life. Others on the other hand are saying that they use mathematics on a daily basis in their profession or in their hobby. There are people who just love mathematics! Despite the range or use of mathematics they do all relate personally to the subject.

Background

I have for many years taught mathematics in all grades from year 1 to year 12 and in adult education. I have met pupils that have met and seen mathematics in different ways before they met me as their mathematics teacher. Nowadays I am working with students who are in the teachers' college to become teachers in mathematics and another subject. It is possible that the other subject is the students' main interest, but you would like to think that someone who has chosen to become a mathematics teacher has a positive view of the subject from previous studies. It might come as a surprise for us as their teachers that this is not always the case.

It is of great interest to see where our students are when we first meet and how the journey to this point has occurred.

Our students' experiences give us the chance to discuss the kinds of difficulties and the possibilities we give our pupils. I myself am finding it very important to have this discussion with my students because as teachers we are signalling indirectly or directly to our pupils our own view of the subject. My starting point as a mathematics teacher is not only to teach the subject but to give my pupils and students a positive experience of the subject.

Graphic Representation

The first time I meet my mathematics classes I wish to know how the students relate to the subject. For me an easy way to get to know their mathematics journey so far is to ask them to just draw a graph that describes their mathematics story.

The information that I first want is obtained by asking the students to use a white A4 sheet and to draw a horizontal time axis. The area above is for positive experiences and the area below for negative experiences. They can mark biological years or school years at the axis. If they want to, they can give an explanatory text to their graphs as they proceed.

One example

One graph is started at the age of three where the student could remember his/her first positive experience of being able to count and the feeling of happiness to be able to name numbers. The graph then ascended slightly during the school years going almost parallel to the axis to about eleven years of age. Then it moved downwards reaching a minimum at fourteen years old. Slowly it then moved into the positive area and reached a maximum at the age of seventeen. After that it went down drastically after the beginning of the teacher training program.

Another example

Another student's story is shown in figure 1.

I have translated the explanations the student gave to her graph. After year 1 in the Upper Secondary School she studied at a Folk High School before she took the preparatory course (Basår).

- I had many interests, only nerds liked math
- The first course in the Upper Secondary School very easy, nice
- The next course difficult, boring did not care
- I studied the course again, everything came out right very good teacher!!!!
- The preparatory course was stressful

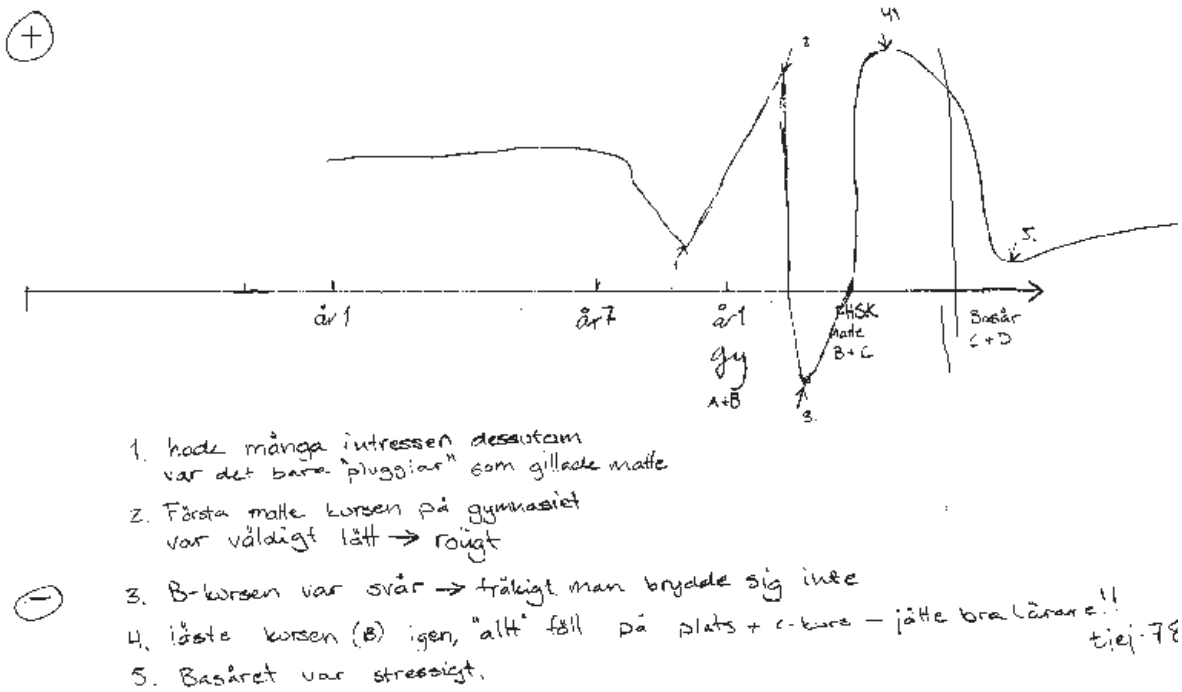

Figure 1.An authentic graph

Stories

After the students have graphed their story they show the graph to the person sitting next to them and share their work in pairs. They then continue the discussions in small groups. After a while we reflect together in the whole class, taking notes of what we think as important facts to discuss further in order to go into more general aspects.

The drawing of the graphs gives the pupils or students possibilities to share their experiences and to reflect about their own story among all the other stories. Later on they might want to revalue their own story/history. This activity is also good to have in the beginning of a course or semester as the students or pupils get a chance to know each other. This was a bonus for the students when I was getting my information. In the group they will find different stories and some students will find graphs that are very similar to their own, but the story behind the graph can differ. It is interesting to listen to the memories and explanations the students give to their graphs.

Interpretations

What information can I as their mathematics teacher get from their graphs? What stories are they telling? Above all the stories are personal stories. The stories are told as they today remember and look back upon what has happened. They contain both affective and cognitive dimensions. I can only be there and look at the graph and listen to the interpretations given by the one who drew the graph. After that the students and I might find explanations together and obtaining support from theories research and maybe then we can look back to analyse the graph further.

In my discussion with them I have focused especially at the points where the graph is changing direction. With some of the explanations and stories following the graph activity I have tried to group using a phenomenographic approach. Someone else might have used other approaches to analyse the graphs to come up with different and interesting issues.

Some of the factors which I have found affect their graphs at these points of change are listed here.

External to school factors

- Changing text book, group, class, teacher, school
- Moving to new country, city
- Changed family situation
- Inheritance, sex, gender

Internal school factors

- New school subjects
- Change of interest
- Motivation, power of endurance, effort
- Ways of working, modes of working
- Affects

External to subject factors

- The organisation of the subjects, positions in the schedule, lack of time
- Teaching material
- System of assessment
- System of grading
- The contents of the subject compared to other subjects

Internal subject factors

- Different content within the subjects
- Pre knowledge
- Expectations
- Teacher

When the students or pupils give explanations of why the subject mathematics is experienced as positive or negative they are using different factors. The same subject can have been experienced as fantastic and awful over time, by

the same person. Some of the explanations are affective, others cognitive. Many of our students dropped the subject because they felt blocked and frustrated when they were about to solve a problem with mathematical content. One thing that I have really noticed is the fact that the student do not so often relate to specific content in mathematics. In the reflection part the content might come up though. When the desire to learn mathematics and when the interest in mathematics has been good or excellent the students often have given the credit to the teacher.

Desire (Lust) to Learn

This is the title of one of the national reports with focus of mathematics but it is suitable for what often has been critical from what the students graphs are telling. It is a lot about having or not having the desire to learn and to get motivated to work with the subject.

Through presentations of the graphs and the following discussions different aspects from the report and relevant research has been able to relate to the experiences from the graphs. The students do appreciate that their stories of earlier experiences are taken seriously. By linking their stories to research they can also get a new perspective of their own mathematics background. The students are able to take a small step in the direction of becoming a teacher with good personal experiences of being a student of mathematics.

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