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## Meaning in Mathematics Education: a Political Issue

### Significado em Educação Matemática: uma Questão Política

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#### Abstract

By a politics of meaning I refer to the social, economic, cultural and religious conditions for experiencing meaning. I refer as well to the layers of visions, assumptions, presumptions and preconceptions that might construct something as being meaningful. By addressing different politics of meaning in mathematics education I want to show how meaning becomes formatted. In order to do this, I provide a foreground interpretation of meaning. The basic idea is to relate meanings and foregrounds, acknowledging that foregrounds are formed by a range of factors, as well as by the person's experiences of such factors. Politics of meaning can be analysed with reference to sexism, racism, instrumentalism, and political engagement.

**Keywords:** Politics of meaning; Foreground-interpretation of Meaning; Sexism; Racism; Instrumentalism.

#### Resumo

Por uma política de significado, me refiro às condições sociais, econômicas, culturais e religiosas na experimentação de significados. Também me refiro às várias camadas formadas por visões, suposições, pressuposições e preconceitos que podem construir algo como sendo significativo. Ao abordar diferentes políticas de significado na educação matemática, espero mostrar como o significado pode se tornar formatado. Para tanto, discuto uma interpretação baseada em *foregrounds*. A ideia básica é relacionar significados e *foregrounds*, reconhecendo a influência de uma série de fatores, e das experiências pessoais relacionadas a estes fatores, como elementos que moldam *foregrounds*. Políticas de significado podem ser analisadas com referência ao sexismo, racismo, instrumentalismo e engajamento político.

**Palavras-chave:** Política de Significado; Interpretação de Significado baseada em *Foregrounds*; Sexismo; Racismo; Instrumentalismo.

Meaning is a socio-political construction. Experiences of something being meaningful, or without meaning, are formed through a range of parameters. Providing interpretations of meaning, however, is a classic philosophic preoccupation with a range of conceptual and analytical ramifications. Discussions of meaning in mathematics education have also been addressed with profound philosophical references.

I want to highlight that meaning in mathematics education is also a political issue. *A politics of meaning addresses the social, economic, cultural and religious formation of experiences meaning, and it addresses the layers of assumptions and preconceptions that might*

*establish meaningful (or meaninglessness)*. In the following when talking about meaning, I always refer to meaninglessness as well.

I will start looking at interpretations of meaning in mathematics education which to a large extent has provided a de-politicisation of the issue. Contrasting such interpretations, I will provide a *foreground interpretation of meaning*, which helps to reveal the complex formatting of meaning. This interpretation will establish terrain for a politics of meaning in mathematics education, which I will address through a few examples.

### **Meaning as a de-politicised issue**

In mathematics education one can identify different approaches to meaning. For instance, one addresses meaning in terms of possible *references* to mathematical notions; one relates meaning to familiarity; one relates meaning to the *participation* in inquiry processes; and one associates meaning to the possible *uses* of mathematics.<sup>1</sup>

Acknowledging referential theories, attempts have been made to establish meaning through a careful decomposition of mathematical concepts. Thus the meaning of, say, the notion of a function has to be established through a carefully elaborated route that introduces the notions set, ordered couple, and set of ordered couples, before reaching the very definition of function. Thus the referential theory of meaning provided a defining feature of the New Math Movement.

Many studies as well as many practices highlights the importance of establishing meaning in mathematics education by carefully relating mathematical notions and techniques to phenomena and procedures with which the students are already familiar. The importance of familiarity has, for instance been highlighted in much literature in ethnomathematics.

The critique of the New Math Movement included a critique of the referential theory of meaning, and inspired by the work of Hans Freudenthal students' experiences of meaning became related to their participation in mathematical activities. This idea developed in many directions, and the whole inquiry approach in mathematics education elaborates on meaning in terms of participation.

The use-oriented interpretation of meaning has many proponents. The general idea is that students would come to experience meaning in mathematics education when they experience

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<sup>1</sup>For broader presentations of perspectives on meaning in mathematics education, see, for instance, Kilpatrick, Hoyles and Skovsmose (Eds.) (2005); and Thompson (2013).

applications of mathematical notions and techniques. This could be in terms of mathematical modelling, but it could as well be in terms of selected examples of uses of mathematics.

Certainly, there are huge differences in interpreting meaning in mathematics education in terms of references, participation, familiarity or uses. However, different as they are, these patterns of interpretation also reveal a principal similarity: They tend to elaborate on the apolitical nature of meaning.

I try to provide a politicisation of the discussion of meaning by relating meaning to conditions and prospects for actions. I am going to pay attention to the socio-political formation of the horizons towards which actions might be directed. I see leaning as a way of acting, and students' experiences of meaning as related to their conditions for completing such actions. I talk about horizons of action as features of the students' foregrounds, and in the following I will suggest a foreground-interpretation of meaning.

### **A Foreground-interpretation of meaning**

The notion of “politics of meaning in mathematics education” emerged while I was formulating an intentionality-interpretation of meaning (SKOVSMOSE, 2015). I operate with a close connection between intentionality and foreground, so I do not make any distinction between an intentionality-interpretation of meaning and a foreground-interpretation of meaning. However, in the following I will formulate the ideas in terms of foregrounds.<sup>2</sup>

### **Foregrounds**

While the background of a person refers to his or her social heritages and the context in which he or she has grown up, the foreground refers to the scope of his or her future possibilities. Like the background, the foreground is structured through a range of parameters, which may refer to expected education, economic conditions, health, length of life, etc. A foreground, however, is not a simple expression of statistical parameters; it is as well formed through the persons' experiences of possibilities and obstructions. Thus a foreground also reflects the person's expectations, hopes, fears, and frustrations.

I have been talking about a person's foreground, but in many cases one can think of a foreground as referring to a group of people. Thus many people might be submitted to the same

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<sup>2</sup>In doing so I draw on formulations from Skovsmose (2015).

set of parameters. But although we might find some general patterns of foregrounds shared by larger groups of people, foregrounds continue to be expressions of individual conceptions as well.

One can talk about foregrounds in the plural, and this plurality might be considered an intrinsic characteristic of foregrounds. Thus it does not make sense to talk about *the* foreground of a person as if it were a well-defined entity. The person makes interpretations, changes interpretations, and comes to think of new possibilities. As part of a project presented in my book *Foregrounds* (SKOVSMOSE, 2014a), we interviewed a group of young people, around 14 years old. One of them told us that he was ready to start working in a year or so. One possibility was to go to help his brother who was working as a bricklayer. He also mentioned that he might move to live with his sister in a big city, and that his sister was married to a famous professional football player. Being there, he might get opportunities to enter such a career. Then, after a little hesitation, he added that what he really wanted was to become a model. In a most direct way he expressed the multiplicity of his foregrounds, and it might be relevant always to think of foregrounds in the plural, also when we have a particular person in mind.

## Meanings

The basic idea in a foreground-interpretation of meaning is to connect students' experiences of meaning with their foregrounds. Let me illustrate by an example.

In a school in Rio Claro, the city in Brazil where I live, the mathematics teacher was planning to do some project work. She proposed different topics, and so did the students. They suggested working on surfing. The teacher, however, had some doubts about this proposal. The school was situated in a poorer neighbourhood in Rio Claro, located in the interior of the São Paulo State. The teacher knew it was most unlikely that the students had been traveling, and only a few, if any, might have ever seen the ocean. How could a project about surfing make any sense to them?<sup>3</sup>

If we think of meaning as established through references to situations familiar to the students, the teacher's worry seems justified. It would be difficult for the students to connect features from their environment with surfing; the project seems devoid of meaning. The conclusion appears the same if we think of meaning in terms of use – far away from the sea, surfing is a useless activity.

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<sup>3</sup> For presentations of this example see also Skovsmose and Penteadó (2015) and Skovsmose (2015).

However, if we consider meaning as having to do with foregrounds, the interpretation becomes different. We have, for instance, to consider the students' hopes and aspirations. We have to consider their imaginations, and surfing could make up fascinating images. Maybe the children from Rio Claro had dreams of getting to the ocean. Maybe they had watched programmes about surfing on the TV. Maybe they imagined becoming famous – Brazil has many famous surfers. Their foregrounds might be structured in all possible ways, and also informed by a number of stereotypes. Anyway, it is with reference to such foregrounds that students come to experience meaning of the activities in which they become involved. In fact the surfing project was concluded with much dedication from the students.

Naturally, one can consider relationships between the activities in which the students are involved and their background. This is the idea of a background-interpretation of meaning. However, *the basic idea of a foreground-interpretation of meaning is that students' experiences of meaning first of all become established through lines connecting the activities in which they are involved and their foregrounds.*

### **Examples of politics of meaning**

In order to explore politics of meaning it becomes important to explore how foregrounds, and therefore experiences of meaning, become formed through a range of social, economic, cultural and religious factors including layers of assumptions and preconceptions. I am going to illustrate through some examples.

### **Sexism and meaning**

During the 1960s, Denmark and the rest of the Western World witnessed a period of technological optimism, which however continued to be combined with a profound exclusion of women from completing further studies in technical disciplines, including mathematics. Until that time it had not been easy for women to move in the direction of mathematics-dense studies. I entered Copenhagen University in 1968, and I only remember one woman among the academic staff in the Department of Mathematics. Until then the dominant outlook had excluded mathematics from women's horizons.

In order to interpret girls' priorities and achievements with respect to mathematics, one can refer to their backgrounds. Thus one can refer to the ways girls are positioned in the family and

the cultural traditions they become subjected to, and certainly one can obtain a range of interesting interpretations this way. However, I want to pay particular attention to the formation of girls' foregrounds and in particular to the observations that these foregrounds can be stereotyping, humiliating and stigmatizing. It is, however, with reference to such formation of these foregrounds that girls come to experience meaning, of lack of meaning, in engaging with mathematics.

Thus in order to interpret girls' achievements in mathematics, it becomes important to consider the formatting of their foregrounds. Such formatings change during time and reflect particular socio-political contexts. It is precisely such formatings that form the girls' experiences of meaning, of the lack on meaning, in being engaged in the learning of mathematics. For many it might be too difficult to perceive connections between the school mathematics activities and their foregrounds.

### **Racism and meaning**

Racism can be acted out through formal regulations and institutions as well as through stereotyping, humiliating and stigmatising discourses. With reference to South Africa, one can talk about the topology of apartheid. This topology concerns the structuring of the physical space as well as the ideological structuring in terms of rules and preconception. This topology was implemented during the apartheid period, although certainly anticipated by the whole colonial system.

The physical structuring provided by this topology concerns the segregation of different groups of people. Do we consider the city of Durban, which I have visited several times, one finds the black townships scattered around the city, while its centre was defined as a white area. The Indian areas are located as buffer zones between the black townships and the white areas. However, this structuring does not only concern the distribution of residential areas. It concerns the location of work places; it concerns the distance different groups have to travel to work; it concerns the organisation of the whole transport system; and it concerns the location of hospitals and schools. The topology concerns the distribution of any kind of possible services; and it concerns the distribution of wealth as well as of poverty. The ideological structuring associated to the topology of apartheid concerns all the priorities that constituted the overall racist world-view.

It concerns the way one sees each other, the way one addresses each other, and what one expects from each other.

The apartheid regime has come to an end, but to a great extent the topology of apartheid remains. Thus the physical structuring can only be changed during a longer period of time. One can only change the location of neighbourhoods, the distribution of work places, and the infrastructure as part of long-lasting initiatives. The explicit rules of apartheid were changed when South Africa became a democracy. However, the ideological structuring demonstrates a considerable inertia. As a consequence, South Africa still suffers from a topology of apartheid.

The formation of South African children's' foregrounds takes place within this topology, and as a consequence this topology conditions what they might experience as being meaningful or not. This also applies to mathematics education. What might students expect with respect to further education? What job opportunities could they imagine? What uses of mathematics might they come to experience in the future? The students' experiences of meaning in mathematics education depend on their position within the topology of apartheid.

I have talked about the topology for apartheid, but one can find very many different versions of stereotyping, humiliating and stigmatizing topologies. They condition the formation of students' foregrounds and, as a consequence, their experiences of meaning. This applies to black students, to girls, to immigrants, to marginalised students. In fact it applies to everybody. Thus the foregrounds of white students in South Africa are also located within a topology of apartheid, and this also forms their experiences of meaning. In general, experiences of meaning in mathematics education have to be discussed with reference to the topologies that form their foregrounds. This is a crucial idea of a foreground-interpretation of meaning and a politics of meaning.

### **Instrumentalism and meaning**

Stieg Mellin-Olsen (1981) describes *instrumentalism* as a rationale for learning mathematics not related to the content of the learning, but rather to the benefits that can be achieved through the learning. Thus one can try to master some mathematics techniques, not in order to understand mathematics better, but to be able to pass a coming test.

Experiences of meaning reflect the students' foregrounds, and so do forms of instrumentalism. Foregrounds can include features of what one wants to achieve; they can



include illusions; and they can be formed through layers of stereotypes. As foregrounds, also forms of instrumentalism reflect the complexity of the topology within which the students are acting.

In the USA, the Algebra Project was organised by Bob Moses (MOSES; COBB, 2001). The aim of the project was to improve the quality of mathematics education in poor communities and to provide better access to further education for black students. Mathematics exercises a powerful gatekeeping function, and Moses saw algebra as playing a particular role for students passing through the gate. He wanted to ensure that black students were not obstructed in their career opportunities by low scores in mathematics. In order to overcome such obstructions it became crucial to engaging back students in the existing curriculum; which forms the logic of the gatekeeping – and the aim of the Algebra Project was to help black students mastering this logic.

Black students participating in the project might experience meaning in what they were doing. This experience can hardly be interpreted in terms of traditional theories of meaning applied in mathematics education. Thus we will get only a superficial understanding if we address the meaning associated to the Algebra Project in terms of references, familiarity, participation or uses. Rather we have to pay attention to the opportunities that might emerge in front of the students. The meaning has to do with the students' hopes, priorities and imaginations; it has as well to do with overcoming fears and aversions.

I follow Mellin-Olsen in assuming that instrumentalism is an important phenomenon to consider with respect to mathematics education. However, I do not assume that instrumentalism as such represents a questionable attitude. Instrumentalism is a complex phenomenon; it has to do with experiences of meaning as related to the topology within which the students are located. Instrumentalism may indicate that some line have been established between the students' learning activities and features of their foregrounds.

### **Political engagement and meaning**

The school mathematics tradition can be characterised in the following way (SKOVSMOSE; PENTEADO, 2015): (1) The activities in the classroom are first of all defined through the chosen textbook. The teacher provides an exposition on a particular topic, which defines the tasks for the students. (2) The pre-formulated exercises play a dominant role, as solving exercises is considered essential for the learning of mathematics. These exercises

demonstrate three particular characteristics: all the information given is exact and should not be questioned; all the information given is necessary for solving the exercises, and also sufficient as no other information is needed; the exercises have one and only one correct answer. (3) One important feature of classroom practice is to eliminate errors, as “doing things correctly” is considered equivalent to “learning mathematics”. (4) The students’ performance has to be evaluated, for instance through the teacher’s questioning approach; through the teacher’s control of the students’ solutions of exercises; and through different forms of tests.

One could claim that the school mathematics tradition turns mathematical activities into meaningless exercises. However, one could also consider the possibility that the school mathematics tradition *exercises* a particular politics of meaning. Within this tradition, particular forms of instrumentalism can be stimulated. It can come to be experienced as meaningful, at least by some students, to complete the designated exercises, to try to provide the correct answers, to provide prompt answers to the teacher’s questions, and so on. Thus I do not see a particular activity as being meaningful or meaningless by itself. Rather, experiences of meaning are constructed, and they can also be constructed within the school mathematics tradition and its accompanying forms of instrumentalism.

However, there are radical different ways of exercising a politics of meaning, as for instance proposed by critical mathematics education. I do not differentiate between critical mathematics education and mathematics education for social justice, so it is a rather broad trend in mathematics education that I have in mind (see, for instance, SKOVSMOSE, 2011, 2014b). In critical mathematics education one finds suggestions for project works addressing for instance: pollution, violence, social exclusion, distributions of income, sexism, racism, ... (see for instance, GUTSTEIN, 2006; BARTELL, 2012).

The introduction of such issues in mathematics education certainly represents concerns for establishing meaningful mathematics education. Thus it has been broadly assumed that socio-political significant examples become experienced as meaningful by the students. Without any hesitation I find that such examples are relevant. However, we cannot assume that political issues and topics concerning social injustice *automatically* become experienced as meaningful by the students. Nor in this case we can associate meaning as a property of the very issues that become addressed.

When students perceive something as being meaningful, we have to do with a constructed perception, and this also applies to issues proposed from a critical perspective. So when projects about fortune, immigration, sexism, etc. may be experienced as meaningful by the students, it has much to do with the complex interactive processes that tend to establish connecting lines between such issues and their foregrounds. Thus a foreground-interpretation of meaning brings us to acknowledge the importance of negotiating meaning. When issues of social justice and injustice come to make part of a mathematics education, we have to do with an example of a politics of meaning exercised through a critical mathematics education.

### **Politics of meaning as a research area**

We have seen examples of different politics of meaning in mathematics education. We have, for instance, related such politics to girls' achievements in mathematics, and considered how the socio-political context establishes a specification and limitation of possibilities within girls' horizons, which in turn might turn mathematics into an irrelevant issue.

One can also associate a politics of meaning to the Algebra Project. Thus, a politics can resonate with an instrumentalism. However, we have to do with several versions of instrumentalism. One such version refers to a situation where students that have suffered social exclusion and injustices get the opportunity to come to master the logic of schooling. This opens new possibilities for them and helps to enlarge their foregrounds; and students might find it meaningful to come to master the mathematics-based logic of gatekeeping.

One can relate politics of meaning to the concerns of critical mathematics education. One cannot assume, however, that addressing forms of social suppression or economic inequalities automatically will be experienced by students as meaningful. The meaningfulness of such activities has to be constructed, which also makes part of a politics of meaning.

Thus there is a range of politics of meaning to be considered. To address examples of politics of meaning is an important research issue in mathematics education. In particular, I find it important to investigate the socio-political formation of students' foregrounds and their experiences of meaning. *I will refer to such research as a Politics of Meaning in Mathematics Education.*

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