

**“BEFORE YOU DIVIDE, YOU HAVE TO ADD”  
INTER-VIEWING INDIAN STUDENTS’ FOREGROUNDS**

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in collaboration with

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**Abstract:** *Students’ cultural diversity is an important factor to consider in a mathematics education concerned with equity. We argue that the significance of mathematics education is not only given by the understanding of mathematical concepts but also by the students’ foreground, that is, the students’ perception of their future possibilities in life as made apparent to the individual by his/her socio-political context. For students in a cultural borderline position different reasons and intentions for engaging in mathematics learning may be related to the construction of meaning in mathematics. Through inter-viewing Brazilian Indian students’ foregrounds, we illuminate the different types of significance given to mathematics education in their particular situation.*

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<sup>3</sup> The “borderline” metaphor has been used in research dealing with cultural diversity. We see *borderline* as a space of individual and social exchange where the meaning of difference is negotiated. A *borderline position* is therefore a relational situation where individuals meet their social environment and come to terms with the multiple choices that cultural diversity makes available for them. For further discussion of related notions see (Chang, 1999; MacDonald & Bernardo, 2005).

## INTRODUCTION

That mathematics education should pay attention to students' cultural diversity is not any new premise for a practice concerned with equity. During the last decade many different research and development initiatives have provided insight into how to conceptualise and realise in practice sensitivity for this issue. It has been evident that the initial focus on mathematics as a cultural activity (e.g. Bishop, 1988) with its emphasis on how different human groups develop mathematical notions has been enlarged to include a wider perception of the different actors who play a role in the practices of teaching and learning (e.g., Abreu, Bishop & Presmeg (Ed.), 2002). The ethnomathematics program has also contributed in an understanding of how different human groups generate and interact with mathematics.

One of the focuses of research concerned with cultural diversity is addressing processes of exclusion associated with traditional mathematics teaching and learning in relation to certain groups of students. Exclusion and inequalities in mathematics classrooms operate on the grounds of students' social class, gender, ability, language, ethnicity and culture. We are particularly interested in issues of culture and ethnicity since this factor has a growing impact on students' exclusion from participation in mathematics learning, at a time of growing heterogeneity among students in classrooms. As internationalization and globalization advance, diversity of people in local communities increase, and so does the risk of reproducing social patterns of exclusion in mathematics classrooms.

In many societies cultural and ethnical diversity has increased with migration of peoples. Normally immigration and emigration are discussed with respect to the moving of groups of people into different geographical spaces from their native ones. The notions of immigration and emigration signify the perspective from which we are looking at the situation. When we see people as entering our society, we talk about immigrants, and when we see people as leaving our society, we talk about emigrants. The situation, however, could be 'inverse', when the actual immigration (or emigration) is not caused by the moving of the group of people in question, but because of changes in the whole socio-political and economic environment. For many indigenous peoples in many countries in the world, their culture and environment has been overrun by external forces. This is not an exception for many indigenous communities in Brazil.

During the time of colonisation the invading powers tried to make slaves out of indigenous people, but Indians were difficult to enslave. They knew the environment all too well, and could escape slavery by withdrawing deeper and deeper into the forest, leaving behind a huge land for the invading people to take over. This withdrawal of indigenous peoples seems to have continued ever since, although compensated by the Brazilian government turning some areas into a *reserva indigena* (Indian reserve). Here the indigenous people may experience a *borderland position*<sup>3</sup>. On the one hand, they can preserve some of their traditions and ways of living, although they can do so only in an environment, which seems always in danger of being overrun by industrial interest: mining, the exploitation of the forest, or farming, all of which always try to carve deeper into the *reserva indigena*. On the other hand, the Indians are well aware of the strengths and powers of the Western civilisation, for instance in terms of possibilities for improving life conditions in general, and

health care in particular<sup>4</sup>. In the case of indigenous peoples in Brazil, it is the rest of the world that, so to say, is moving by turning up right outside their natural environment. The consequence, however, is the same: a group of people experiences a borderland position with references to two different cultures.

How does experiencing a borderland position influence students' motives for learning? We expect that in general motives for learning are related to a person's background as well as his or her foreground. Background refers to a person's or a group of persons' cultural and socio-political roots; and foreground refers to a person's interpretation of learning and 'life' opportunities, which the socio-political context seems to make available. For a student in a borderland position, however, background and foreground as well as the relationship between them could easily be structured by conflicting priorities and possibilities. What does the socio-political context allow students in a borderland position to hope for and to expect as being part of their ('realistic') possibilities?

In this sense indigenous students' situation is similar to the situation of (other) immigrant students. Thus, we might be able to learn more about the situation of immigrant students by considering more carefully the case of Brazilian indigenous students. In this country there has been a strong concern for formulating what a mathematics education facing cultural complexity and diversity could mean. Research literature, not least the one developed around the ethnomathematical programme, has demonstrated a great sensitivity with respect to cultural diversities. It has been emphasised that education cannot remain a form of cultural invasion; rather, an activity where cultural diversity is respected and taken seriously into account.

In this context, the issue of *meaning* or *significance* becomes important. We see meaning and significance of mathematical learning activities as related to the students' foreground and background. Therefore, we find that it is of paramount importance to investigate students' foregrounds in order to clarify motives for learning. To students in a borderland position these motives for learning might reveal a deeper complexity and they might include conflicts and dilemmas, which we hope to be able to clarify further. This is our intention in this paper.

## **ETHNOMATHEMATICS AND MEANING**

The ethnomathematical programme, introduced world wide by Ubiratan D'Ambrosio's plenary at ICME-5 in Adelaide, puts into focus the idea that mathematics operates in a variety of cultural settings. This programme broadens the concept of mathematics: not only can we experience mathematics in textbooks and in mathematical research journals, but also in any form of handicrafts, for instance as represented in construction of houses or of boats for sailing at the Amazon River. Mathematics can be integrated in tools, craftwork, arts, routines. It can be part of a chair as well as of a computer. D'Ambrosio has interpreted the notion of ethnomathematics by considering its three conceptual elements: ethno-mathema-tics. 'Ethno' refers to people; 'mathema' to understanding; while 'tics' refers to techniques as well as to art.<sup>5</sup> Thus, ethno-mathema-tics refers to culturally embedded ways

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<sup>4</sup> We do not consider the exceptional cases where Indian groups live in a much more profound isolation.

<sup>5</sup> See, for instance, D'Ambrosio (2001). See Ribeiro, Domite & Ferriera (Eds.) (2004) for a recent contribution to the ethnomathematical research programme. See also Gerdes (1996); Powell &

of understanding. It must be noted that the notion of 'mathema' is broader than 'mathematics' as we normally consider it; that 'ethno' has to be understood as people/culture, and that it does not include any reference to 'ethnicity' (understood as a racial category).<sup>6</sup>

According to the conceptual delineation of ethnomathematics, we could talk about the mathematics of bakers, carpenters, street children, vendors, bank assistants; we could talk about the mathematics of the Incas, as well as of tele-engineers, system developers, dentists, statisticians and mathematicians; and we could also talk about the mathematics of students in a borderland position. In other words, we adopt the idea that every community develops a particular mathematical practice; and such a practice is meaningful for participants in it. We are not interested in digging out the characteristics of the mathematics of indigenous students. We are rather willing to investigate the perception that they have about who they are, their life in the *reserva indigena*, schooling and, in particular, the meaning they give to learning mathematics. In this perception we hope to find the motives that they have for learning mathematics. As mentioned before, such motives could be found in the background as well as in the foreground of the students.

'Foreground' refers to a person's interpretation of learning and 'life' opportunities, which the socio-political context seems to make available.<sup>7</sup> Thus, the foreground is not any a priori given to the person; it is a personal interpreted experience of possibilities. We talk about 'multiple foregrounds', as a foreground can be acted out in different ways, depending on the situation. A person does not necessarily maintain a universal foreground, but he or she could switch between different foregrounds. To a teenager dreamy and realistic elements may be mixing. Depending on the situation different foregrounds could be brought in operation, and in this way serve as motives for actions and for bringing intentions-in-learning. Foregrounds are changing, and we can observe a strong discontinuity. Suddenly, a new way of looking at one's possibilities may emerge. This can, for instance, be due to change in the social environment. New motives for learning can emerge, apparently out of the nowhere. *A foreground is not a particular 'thing'*, which we as researchers could hope to discover in a proper way. It does not make sense to ask: What is the real foreground of a person? A foreground is a dynamic interpretation of person's or a group of persons' future possibilities.

Apparently a background is a more stable unit than a foreground. However, also a background is an interpreted phenomenon. As one can see one's possibilities in different

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Frankenstein (Eds.) (1997); and Knijnik (1998, 2002a, 2002b, 2002c). It should be noticed as well that 'tics', in the interpretation proposed by D'Ambrosio, refers to techniques in the broadest sense, including arts. In fact, art plays an important role in the ethnomathematical programme.

<sup>6</sup> The ethnomathematical research programme has proliferated worldwide. Thus, we can see studies dealing with mathematics in sugar cane farming (Abreu, 1993; Regnier, 1994). Duarte (2003) addresses the 'world of construction', for instance the mixing of mortar (sand, cement, water). Giongo (2001) analyses the practice of shoemakers. See also Fernandes (2002, 2004). In Brazil researchers and practitioners have struggled with the problems of dealing with hybrid forms of knowledge that characterise the life conditions of many groups of Indians (see, for instance, Amancio, 1999; Scanduzzi, 2000, 2004). Knijnik (1999) addresses the education for landless people in Brazil. Recently the perspective of street children has been addressed by Mesquita (2004) by investigating the notion of space. Education of indigenous people in Brazil has been addressed by Ribeiro & Ferreira (2004) and Silva (2006), while the overall ethnomathematical approach has been addressed by Barton (2004).

<sup>7</sup> See also Skovsmose (2005).

ways, so can also one's background be interpreted and reinterpreted. Sometimes it can appear a valuable resource; sometimes it appears to be an obstacle for getting on in life. Both foregrounds and backgrounds are resources for people to construct motives for learning. From these resources intentions can be put into learning.

For students in a borderland position one could expect that conflicting elements in and between foregrounds and backgrounds would appear in forms of approaching learning. These elements might influence the way students see meaning in education. In what follows we inter-view some students in an Indian village in order to illuminate this point.

### **THE VILLAGE KOPENOTY**

Kopenoty is located in a reserva indigena, in the centre of the State of São Paulo, about 30 kilometres from Baurú, a city of about 500.000 inhabitants. Baurú has several universities, a department of the State University of São Paulo being one of them. Further there are many Faculties in Baurú one being Faculdade do Sagrado Coração. In the State of São Paulo there are several other reservas indigenas, most of them close to the coast line.

Kopenoty has a school built by the government of the state. This is a simple brick building, although a huge improvement compared to the round straw roof, which could provide some shadow for the few benches that up to then had made up the school facilities. The houses in the village are very small. They are hiding around in the landscape. Recently electricity has been installed. In the middle of the village, we see a small soccer field.

It is difficult for an outsider to get access to this village. The Indians are suspicious of any white person trying to get access. They could be suspicious of the white person's motives. They could also simply be tired of having interested people sneaking around. In this case access was granted by the chief of the village. And he, in turn, would consult the federal department responsible for the security of the reserva indigena. Only after such procedures one could get the permission to enter.

### **INTER-VIEWING FOREGROUNDS AT KOPENOTY**

When investigating foregrounds we consider the relationship between the interviewer and the interviewee. We suppose that foregrounds exist as constructions that cannot necessarily be found in any 'true' or 'pure' form. Therefore, it is legitimate for the interviewer to engage in an active interviewing as a way of revealing and co-constructing multiple foregrounds. Steiner Kvale (1996) has used the expression inter-viewing.<sup>8</sup> We find that this elegant formulation of 'seeing together' condenses nicely our approach to researching foregrounds. From the part of the researcher, there is no hidden agenda, i.e. something in the research design that we keep secret from the person whose foreground is investigated in order to obtain 'validity' in the research. This makes it possible to consider *dialogue* as an adequate research approach (see for example Stentoft, 2005). Through dialogue and collaboration perspectives can be stated, examined and challenged, and the participants can get to examine their own thinking more clearly. Therefore, we think of dialogue as a methodology for inter-viewing foregrounds.

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<sup>8</sup> See also Steentoft (2005).

The inter-view with the students was conducted by Ana Paula Silvério, who was granted the access to the reserva indigena. One reason is that Ana Paula had a good contact with the group since she has worked with teacher education there. Pedro Paulo Scandiuzzi has provided further information about the people from Kopenoty. He has worked for many years with indigenous people in order to develop a mathematics education with references to their cultural environment. Some time after the inter-view was conducted Ana Paula and Ole visited the village. However at that time the students were not available for any follow up inter-viewing. So what we are presenting here we have been seeing through the eyes of Ana Paula, Pedro Paulo and Ole, and we will come to listen to the students' voices through the inter-views conducted by Ana Paula and translated from Portuguese by Anne Kepple.

The day and the scene of the inter-view was described by Ana Paula in the following way:

The inter-view in the Kopenoty village was scheduled for the 26th of September, 2004, at 9:00am on a Sunday. The night before, the Indigenous people had participated in a party sponsored by a candidate for city council, with a lot of food, drink, and forró (dance music from north-east Brazil). I waited until the scheduled time, but by 10:00, no one had arrived for the inter-view. While I waited, I talked with Mauria (white woman married to an Indian named Chicão who works for FUNAI [the Federal Bureau of Indian Affairs]). She suggested we go to the residences of some of the young people to conduct the work, which we did, not having any other option. The inter-view didn't have the expected result, as when we arrived at their houses, despite the good reception, they had to stop what they were doing to talk to us. I felt that they were very intimidated, and this made it difficult for me to do what I had planned to do as the inter-viewer: conduct an informal, relaxed inter-view. I also think that Mauria's presence made the young people even more introverted, in addition to the tape recorder used to record the conversation, which compromised the ease/agility of the interviewees. Initially, the idea was to conduct an inter-view with two couples, which was not possible. I was able to inter-view only two men and one woman. I don't know if Mauria's comments should be taken into consideration, as with each answer given by the Indians, she interfered.

In this description of the context of the inter-view Ana Paula cannot hide her disappointment about the whole situation. She seems to have expected something different and she makes her reservations. Anyway, in what follows we shall have a close look at the inter-viewing.

### **The students**

Ana Paula first asked the students to talk about their city and neighbourhood. She told that they could try to describe things for a person who did not know their village:<sup>9</sup>

Ana Paula: Where do you live? Talk about your city, neighbours. Imagine that you have to tell this to a person who lives far away from here – in Denmark, let's say.

Maria Luiza: I'm Maria Luiza. I'm 17 years old. I've lived here in the village Kopenoty since I was born. It's in the municipality of Avai, and is close to Baurú. The village is

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<sup>9</sup> It is common that Indians, besides their own name, use a Latin name in situations where they prefer a degree of anonymity. The names used here are their chosen Latin names.

quite large, and we are all family here. I live with my father and my sister. Most of my friends are from the village here, and I also have friends from Baurú and other schools.

Patrick: I'm 17 years old. I was born in the city and used to come here on the weekends. When I was a bit older, I decided to come live here in the village with my grandfather. I couldn't get accustomed to the ways of the city; everything here in the village is calmer. The work is harder, because we have to work in the field. The village is big, and there is plenty to do here. There's a reservoir where we swim, and a soccer field. I'd never leave the village now. My girlfriend is pregnant, and we're going to live together. We plant and harvest manioc here. We have other things, too, like the vegetable garden.

Matheus: My name is Matheus. I'm 16 years old. I've lived here in Kopenoty since I was born. My mother used to live in another village, but when she and my father got married, she came to live in his house. The other village is Nimuendajú. I always go there; I have relatives there, too. But my friends are from right here. We play soccer every Sunday in the soccer field. We play against some teams from Avaí. We have lots of parties here, too, and at the parties, we dance forró.

The students all emphasize that they are strongly located in the village. Although Patrick is not born in the village he has no doubt that he will stay there: "I'd never leave the village now". He "couldn't get accustomed to the ways of the city", he says. He probably refers to pace and noise, as he declares that "the village is calmer". The others have lived in the village since they were born and have all their relatives, friends, and activities there. That Kopenoty is positioned in a borderland position is underlined by the fact that Maria Luiza has many friends in the village as well as in Baurú.

In the following we will focus at the students' foregrounds. We will make references to the school, their friends, how they experiences mathematics, how they see their future, and how they see mathematics with respect to this future. We will discuss these elements as part of their landscape of learning mathematics<sup>10</sup>.

### **The school**

Ana Paula: What do you think about going to school? What do you like and what do you not like about school?

Maria Luiza: I like to go to school. There are a lot of different kinds of people there. I just don't like going to Baurú to study. It's far away, and you get too tired. Since it's at night, I get very sleepy.

Patrick: I agree that it's very tiring to leave the village here and go study in Baurú. Maybe if the classes were in the school here [in the village] we would get more out of it. I get tired and I have to force myself to pay attention to the teachers. But since I like to study, I go.

Matheus: I think, too, that it's tiring to leave the village to go to Baurú or Avaí to study. If it were here in the village, I think even people who have dropped out would

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<sup>10</sup> In Alrø, Skovsmose and Valero (2005) we have discussed the notion of landscape of learning for the investigation of mathematics education in multicultural settings.

go back to school. I have lots of friends who don't like to go to the city to study.

The students agree that they do not like to go to Baurú in order to go to school. They are about to finish the upper secondary school, which makes choices about the future important: What to think of their possible further studies? Continuing in Baurú signifies entering universities or faculties, and thereby entering a radical different environment. Remaining in the village means remaining in the indigenous environment. The choice is existential: two radical different life-lines could be formed. The remoteness of Baurú is expressed in terms of distance, but this distance can be understood first of all as a cultural distance. The students share the wish of taking an education in their own village instead of having to join another culture in Baurú. This seems to bother them. And why do they have to study at night? We do not get the answer to this question, but there might be a hidden conflict here.

### **Friends**

Answering the previous questions all three students touch upon the issue of friends. Friends seem to be an important element in their thoughts and priorities.

Ana Paula: Who are your friends? What do you like to do with your friends? Do you talk about the future sometimes? What do you talk about?

Maria Luiza: My friends are Fabiana, who is my cousin, and Eluza. We stay in the village more than go to the city. We go to the parties and dance forró. When I go to Fabiana's house, we like to listen to the radio. Now, I don't remember exactly what we talk about the future. But I know Eluza wants to be a dentist. I want to be a teacher and teach little kids. It's because I like children, that's why.

Patrick: My real friend is my grandfather. We are very good friends. Since I go to work in the field with him, we talk the whole day long. He tells me that he would like me to get an education. He thinks that I could help our people more if I study. But I have other friends, too. I have one from the college prep course who is cool. His name is Marcos and he wants to study how to work with computers. I want to be a nurse.

Matheus: I have lots of friends – those from my class, and others from the village. We make plans with our friends from the city to go out in the square there in Avaí. Sometimes they come to the forró here in the village, too. Talk about the future? Sometimes we talk, yes, but I still don't know exactly what I want. In the third year of high school I'll have to decide, so later on I'll resolve that.

Maria Luiza mentions her two best friends by name. They prefer to stay in the village and join the local activities: parties, they dance forró (a popular Brazilian dance, and not any indigenous dance) and listen to the radio. Maria Luiza knows that one of her friends wants to become a dentist, and she, herself, wants to become a teacher.

Patrick's best friend is his grandfather. He previously mentioned that he came to live in the village with his grandfather. And now he mentions that his grandfather want him to have an education in order to "help our people more". The two of them obviously have a strong relationship. Patrick and his grandfather work together in the fields and they "talk the whole day long". Patrick has also got other friends. He knows one who is working with computers, and he himself wants to become a nurse.

Thus, both Maria Luiza and Patrick have chosen helping professions for their future life. And they want to use their education in the village for the indigenous people.

Matheus has many friends, both in the class and in the village. They are meeting here and there, but time has not come for Matheus to consider his future life. Schooling brings young people to a crossroad. In a country like Brazil we find enormous differences between salaries. Different career opportunities really signify radical different life opportunities. For the indigenous students the differences are even more dramatic. The crossroad represents two radical different opportunities in life: not only in terms of economy but also in terms of cultural choices.

### **Mathematics**

Ana Paula: What are you doing in mathematics class? What have you already learned in mathematics?

Maria Luiza: We're learning [algebraic] equations. I don't like this subject very much. I think it's difficult – I can't get it into my head. I liked doing calculations, but I didn't know it very well. We had sets, theorems, natural numbers, too, and that delta, which is very difficult.

Patrick: In the college prep course, I learn all the subjects taught in high school. I learned the theorems, [algebraic] equations, roots, how to transform meters into kilometers. I learn a little of everything, since they are the subjects you need for the college entrance exams. When I was young, I liked to do problems and multiplication. I have trigonometry, which is difficult, and is often on the test.

Matheus: I think it's kind of boring, this subject. I think it's because I don't pay very much attention. I don't like the teacher very much, either. She goes too fast; there is hardly enough time. I am learning to find the area of a square or a rectangle, but I think that's geometry. I am also learning cathetus and hypotenuse. The teacher is giving it to us in school. But it's very difficult for me to learn.

Maria Luiza is learning about equations, and she does not like this. It is difficult, and such topics "does not enter her head". She likes to do calculations, but they have also set theory, theorems, natural numbers, and a formula which contains the Greek letter " $\Delta$ ".<sup>11</sup> Such things do not make much sense to her.

Patrick experiences things quite differently. He seems to have grasped most of the things, and he liked mathematics, also when he was younger. The main motivation, however, seems to be the 'vestibular', the examination for entering universities, and he explicitly refers to the topics they are addressing in mathematics as being of relevance for the vestibular, which determines the entrance to a university or not. In Brazil the upper secondary school does not conclude with a formal examination. Instead each and every university organise its own entry test. The students, then, have to sign in for the tests at the particular university, and hope that the result of the test is good enough for being accepted.<sup>12</sup>

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11 The  $\Delta$  refers to the discriminate playing a role in solved quadratic equations.

12 The universities start at the end of February or at the beginning of March, and during December and January the students, who try to enter universities, go to tests here and there. Naturally, they have to try several universities, as the results of the test are only published later. It could well be that one is not successful at any of the tests (Thus, in many of the subjects the State University of São Paulo only accepts 1 student out of between 20 and 35 students. The competition among the attractive universities is high). If one does not pass any of the entry tests, one has to study an extra year in order to be better prepared. The tests appear horrifying. All kinds of topics are mixed, and

Matheus thinks that mathematics is boring. He does neither like the content nor the teacher, who does everything too fast, as if there was no time for anything. Matheus learns about areas of squares and of rectangles, and he remarks that this must be geometry, indicating that geometry might be different from mathematics. He refers to cathetus and hypotenuse, so we could guess that the Pythagorean Theorem has passed the blackboard. It all appears to be rather difficult to Matheus.

In these answers it is difficult to hear any comments that reflect that we have to do with a teaching of mathematics in a particular context. Initial comments about mathematics seem universal. It appears that mathematics, as taught according to the school mathematics tradition, is as remote from the students' reality, regardless if this reality is to be found among Indian students in a village in Brazil or among Danish students in Copenhagen. The situation, however, might be different if we leave the school mathematics tradition<sup>13</sup>, but for the moment we are in no position to make any observations about this situation. It simply appears that the school mathematics tradition operates world-wide, and that it has reached deep into the Indian *reserva indigena* with the same effects for the students here as for students anywhere else.

However, when we try to see mathematics outside the classroom, then the different contexts could make a difference. For although, somehow, the mathematics classroom structured by the school mathematics tradition might look almost the same around the world, then the socio-political and cultural contexts in which the students are situated are different. So what to expect of answers to the following question:

- Ana Paula: Outside of school, do you ever use numbers, do calculations, count, make estimations? If so, what kinds of calculations do you do? In what situations is it necessary?<sup>14</sup>
- Maria Luiza: In school with the teacher, we use it a lot. For example, we use division to divide the materials among the children, since if one has more than another, you see how they fight, right? We also use quantity a lot, to know how much to make for lunch and snacks. In arts and crafts we also add and divide.
- Patrick: In the fields, we use division a lot, too. We divide the land according to the seed we are going to plant. We also divide our profits and expenses. We use division for everything, and addition, too, since before you divide, you have to add.
- Matheus: I agree with Patrick. In the fields, or there in the vegetable garden, we use division to divide the area to be planted and the seeds.

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the mathematics tasks presuppose not only a deeper understanding of mathematics, but also fingertip knowledge about a variety of details. If a student should find that a sabbatical year after the gymnasium would be appropriate; there is no chance of coping with the test. One has to enter the test with all the fingertip knowledge necessary. As a consequence, university students in Brazil are much younger than, say, in Denmark. In Brazil one has to enter (or try to enter) immediately after finishing the upper secondary school.

<sup>13</sup> For an analysis of the school mathematics tradition and alternative forms of organisation, see Alrø and Skovsmose (2002).

<sup>14</sup> Naturally, an answer to such a question reflects also what the students might associate with the words. And it was suggested to the inter-viewer not to use the word mathematics. This might provide some "limited" associations. Therefore the words numbers, calculations, count, estimations were used.

Maria Luiza first remarks that one uses numbers in school, but her next utterance shows that she has not the mathematics lessons in mind. She refers to mathematical operation of division as related to the process of fair sharing among children. She adds that calculations are used for the division of snacks and sandwiches and that workers use division much. Patrick continues that people in farming are doing divisions, for instance when one have to divide a field according to what one is going to plant. People are also dividing the harvest, and here one needs addition as well as people have to add up everything before it is divided. Matheus agrees with Patrick. Division is the most common operation in every-day life. To what extent this division is experienced to have much in common with the division in mathematics education is not illuminated, although this might in fact be the case.

### **The future**

Certainly, the students see some mathematics (in the terms of division) in their daily-life environment. But could they see mathematics in the perspective of their future? The idea, which might not be brought clearly through in this formulation is that they need not be restricted in their imagination. They could allow themselves to be rather dreamy and with great hope.

Ana Paula: What do you want to be/do in the future? Where would you like to be living? You can say whatever comes to your mind.

Maria Luiza: I want to be a teacher in the school in the village; give classes to the children and, who knows later on, be a director. But first I have to go to college [the university]. I want to stay always here in the village with my family and my friends.

Patrick: I want to be a nurse to help all my Indian relatives to be more healthy. What I really want is to work in the health post of FUNAI. I think I can even manage to achieve it. But first I have to study for that. I don't want to go live in the city.

Matheus: I don't think I want to live in some other place, no. I like the village. I want to continue working in agriculture.

Maria Luiza repeats her wish to become a teacher and to stay in the village among her friends. Patrick repeats his wish to become a nurse in order to help his whole family to get a better health. Furthermore, he wants to work in the health post of FUNAI. He thinks that he is able to manage, but, as he emphasises, first he must study in school, and this is going to be outside the village for a while. Matheus agrees about the wish to stay in the village, and he wants to continue to work with farming.<sup>15</sup>

Then Ana Paula emphasises that they can be realistic in the expectations:

Ana Paula: Talking realistically, what do you think the future will be like?

Maria Luiza: I don't really know, but I would like it if everyone had the same rights. I want everyone to be equal, even with cultural differences.

Patrick: What Maria Luiza said is true. It would be good if everyone was equal, and everyone respected the other, as we all have different ways of thinking. I would like it if the children of the village didn't have to suffer prejudice because of their race; it may not seem like it, but there is a lot of that here. Just that fact that the children aren't interested in learning the native crafts and mother tongue – they are denying their parents' culture.

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15 It is obvious that the student answers are influenced by one another.

Matheus: This is true. I have friends who only want to date white girls in the city. This is prejudice, too. I want that to end in the future.

The original intention was that the students now had to consider their situation and their expectations in more realistic terms. However, Maria Luiza interprets Ana Paula's question differently. Maybe because they already have been realistic in their previous answers. She makes a very intense statement about what she would hope for of the future: "I would like it if everyone had the same rights. I want everyone to be equal, even with cultural differences." This indicates that she does not experience equality now, and that she is well aware of the problems of cultural differences.

Patrick agrees: Everybody should be equal, and we should respect each other. In particular, he does not want that any children should feel inferior because of their race. And he adds that when children do not have interest in learning the (local) handicrafts and their mother tongue, they are negating their own culture. Matheus agrees and refers to one of his friends who only wants to date a girl from the city. This is, Matheus emphasises, prejudice.

In these statements, we see an example of how the problems of racism are experienced by the young Indians of Brazil. This racism could take the form of self-negation or of lost self-esteem. What is outside the local village, being a possible girl friend, could get paramount values. The Portuguese language, being the language of power, could be the most appreciated language. One counter-move could be a re-establishment of self-esteem. And here we see a crucial element in the ethnomathematical approach, which, in particular, has emphasised the essence of establishing a balanced view of the different forms of knowledge: between curriculum-based school knowledge and the cultural-based knowledge.

What is touched upon here has not only to do with students in an Indian community in Brazil. It has to do with any group of students who come to operate and to learn in a borderland position. There could easily exist an imbalance between the different cultural settings, which are referents for the borderland position. And this imbalance could, for instance, provoke a low self-esteem. The general point is that motives for learning can be facilitated as well as obstructed by a variety of foreground and background factors experienced by students in a borderland position.

### **Mathematics and the future**

Ana Paula: Do you see any relevance for mathematics (or knowing how to count, make estimates, relate quantities, etc.) for your future?

Maria Luiza: I think so. For everything in life, we're going to use mathematics. To deal with money even, we have to have a notion of values.

Patrick: Yes. Everything we learn in school, be it mathematics, Portuguese, or biology. We use the basic notions of each one. Some things, I think, have nothing to do with anything, like the more difficult subjects.

Matheus: You saw yourself in the field that it's necessary to count the seedlings, divide up the seeds and the land. And since I want to continue working in agriculture, that means that I'll always be using mathematics.

First, we should notice that they make a re-interpretation of future. Now it is not any longer the grander hopes concerning greater equality and mutual respect, which defines 'future'. Instead they now take the more limited perspective, assumed in the format of the interview. Maria Luiza emphasises that they are going to use mathematics for "everything in life", and she refers to the issue of dealing with money. Patrick agrees, although he finds

that some of the more difficult things in mathematics useless. Matheus refers to agriculture, where he is always going to use mathematics.

Ana Paula: Do you see any connection between the mathematics you are studying in school and what you would like to do in the future?

Maria Luiza: Ah, very little. For example, what use is an [algebraic] equation if I'm going to be a primary school teacher? I'm not going to teach this to my students. But I'm going to teach division, multiplication, addition, and subtraction.

Patrick: And really, what good is trigonometry, theorems, and roots if it doesn't get me into the university? But in nursing itself, I don't think so. I'll need to know plenty about medicines, schedules, and for that I'll use division; to ask the patient to take a given medicine every 12 hours, it's necessary to know how much medicine for the weight of each patient.

Matheus: I don't think that the cathetus and the hypotenuse are very useful for the farmer. Maybe for me to pass the college entrance exams I should know it, but on the farm, you don't use any of that.

This seems to make a difference. Thus, Maria Luiza thinks that there would be very little use of the mathematics she is learning in school with respect to her future. She is certainly not going to teach her students equations, but calculations. Patrick thinks that entering the Faculty he would use the mathematics he is learning for the moment. Clearly enough he sees that the topics are relevant from the perspective of being able to pass the vestibular. But he adds that for the job of being a nurse, he could not come to think of any use. The relevance of numbers, he sees, has to do with measuring out the correct quantity of medicine, organising the time schedule for taking medicine, and so on. But things like trigonometry would not be of much use. Matheus also refers to the use of mathematics in order to pass the vestibular. But in the fields, he knows about, there no use of Pythagoras.

### **THE SIGNIFICANCE OF MATHEMATICS FROM A BORDERLAND POSITION**

It is interesting to observe how the *significance of mathematics* is expressed through the inter-view. In the beginning it appears that mathematics, as presented in accordance with the school mathematics tradition, is without much deep felt significance. However, the students seem ready to ascribe different forms of significance to mathematics.

First, we can talk about the *instrumental significance* of mathematics. In fact most of what is taught in school, according to Patrick, is relevant when we consider it from the perspective of the vestibular: all kinds of questions could be included in the vestibular. So, if one wants to get further on in life, there is no doubt that mathematics has a big instrumental significance.<sup>16</sup> The instrumental significance appears to be a life condition for students.

One could then consider if instrumental significance is different for different groups of students. If the results of mathematical tests, based on the particular knowledge exercised within the school mathematics tradition, mean a difference for the future of the students, then one could talk about different forms of instrumental significance. Thus, the instrumental significance for, say, children belonging to a dominant cultural group might be

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<sup>16</sup> For a discussion of instrumentalism in learning mathematics, see Mellin-Olsen (1977). See also Mellin-Olsen (1987).

different from the instrumental significance given by a group of immigrant children, when we consider a particular teaching-learning content. For Indian students in Brazil, further education provides the main route out of the village. And if education should in fact come to work in this respect, then it is essential to come to master the knowledge, which becomes the code for moving further in the educational system. In particular, to students in a borderland position, instrumental significance can be of paramount importance. However, this is certainly not the purpose of the inter-viewed students in this paper. The instrumental significance is related to passing exams, but they do not want to leave the village. They want an education in order to be able to help their people.

We could consider other forms of significance. The content of mathematics could also appear significant when it is related to out-of-school practices. A practice that everybody, and every student in particular, is familiar with could establish *daily-life significance*.<sup>17</sup> During the inter-view, the students made statements about this form of significance. Thus the students have no difficulties in relating the processes of division to daily life practices, for instance with respect to doing work in the fields. In such cases the students seem to recognize the daily life significance of mathematics. However this daily-life significance applies only to a very restricted portion of what the students learn in mathematics in school. They emphasise that a great majority of topics seem without any daily-life significance.

With respect to daily-life significance, we have observed many possibilities for cultural dominance. For instance, by ignoring that certain forms of daily-life significance are relevant to address in school, while other forms appears irrelevant.<sup>18</sup> The strength of the ethnomathematical position is that the daily-life significance of the mathematical activities presented for students is carefully dealt with showing a great respect for cultural values. But the way daily-life significance is dealt with in the cultural priorities of school concerns could also include a cultural dominance and affect the students' self-esteem.

During the inter-view, the students shortly touch upon what we could call *expected work-practice significance*. Here we refer to the work practices, which the students might want to enter. So what could be the significance of the issues learned in school, when we consider the work practice of a nurse or of a person working in agriculture? This appears to be cloudy to the students. It is not negated that there could be such forms of significance, hiding here and there in the curriculum. But nothing gets clearly through. One could also talk about *work-practice significance* with the "expected". Thus, one could be aware of a significance of a mathematical insight with respect to bridge construction, estimations of degrees of pollution, cryptography, without assuming that such work-practices are "expected".

There could be other forms of significance. The students made strong statements about the important of equality. They wanted society to become more equal. To what extent, if any, a mathematics education could provide any input to such a development was not addressed. The question to what extent one could imagine that a mathematics education, maybe positioned in great distance of the school mathematics tradition, could provide any input to a general improvement of society was not formulated. One could talk about a *socio-political*

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<sup>17</sup> See, for instance, Civil and Andrade (2002).

<sup>18</sup> Alan Bishop (1990) gives the example of exercises about cricket scores as well as about the speed of the escalator in Holborn presented for black students in Tanzania, during the colonial times.

*significance of mathematics* as well as about a *significance for a critical citizenship*.<sup>19</sup> But such forms of significance were not touched explicitly upon during the inter-view. It must, however, be noticed that the statement about the relevance of further education for helping the people in the village includes a strong statement about solidarity. There might not be a long distance before we could reach a significance for critical citizenship as a possible experienced significance for students.

When students try to see the meaning of what they are doing in mathematics this could be done in different ways. And we have touched upon instrumental, daily-life life, expected work-practice, socio-political and historical significance as well as significance for critical citizenship. These types of significance are interrelated. Naturally, we could expect other forms of significance to emerge from the background as well as from the foreground of the students. We must consider the situation with respect to different groups of students. For instance, what might be a daily-life significance or an instrumental significance for a group of students might depend on the context of the students. And one such particular context is experienced by students in a borderland position, being, for instance, Indian students in Brazil or immigrant students in, say, Denmark.

The significance related to a critical citizenship might also vary from context to context. In fact one could interpret the formulation: "before you divide, you have to add" as a strong expression of solidarity. We have to add (whatever we have) in order to divide (equally) what we have brought together.

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<sup>19</sup> One could also consider a historical significance. This form of significance has been described by Arthur Powell (2002). He shows how an awareness of the African roots of the Rhind Papyrus provides a new significance for the teaching of Afro-American students in New York.

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