

CHAPTER 3

FURTHER DEVELOPMENT OF THE INQUIRY CO-OPERATION MODEL

The IC-Model has been developed with reference to a particular example of communication between a teacher and a group of students. The following key notions describe elements of inquiry: *getting in contact, locating, identifying, advocating, thinking aloud, reformulating, challenging and evaluating*. In this chapter we will reconsider these elements by looking at students' mutual inquiry co-operation.

We analyse group work that contains several new inquiring elements that seem to relate to the notions of the IC-Model. In the final section we will summarise these elements in order to develop the IC-Model to become not only a model of teacher-student communication, but a general model of inquiry co-operation in teaching and learning mathematics that aims at concretising inquiry as a communicative practice. This also includes a discussion of observed communicative patterns that seem to be an obstacle to inquiry co-operation.

'BATMAN & CO.'

We are in a 10th grade mathematics class. This week the students have two lessons in mathematics from 10 to 12 o'clock every day. In this particular school it is possible to set up a different schedule every week, so the students are used to special arrangements. We look at a course of inquiry that takes place in a classroom environment of group work where the teacher plays the role of a consultant. There are no given exercises, but the teacher introduces the students to a landscape of investigation with clearly defined vantage points that allow the students to raise mathematical questions and to solve mathematical problems. This means that they should be able to obtain an idea of what they could be doing in

this landscape. Naturally, this does not prevent them from having to face difficulties. The presented landscape includes references to a semi-reality, but it also includes real-life references.

The class is going to imagine to be the Danish division of an American factory, 'Run for Your Life', that makes sports articles. Every day they get new information and orders that they have to consider. The first day the introduction is: "For the coming promotion campaign we need a large amount of balls. We have bought some black and white leather – 25 m² of each colour..." and a big shopping trolley with many sorts of balls is placed in the 'factory hall'. Cardboard, scissors and glue are also available. Some students begin to examine the well-known black and white handballs and soccer balls. They consist of 12 pentagons and 20 hexagons each. How can the factory begin a production? Later they get this fax: "Our sports centre has burnt down. We have rented a bubble hall of 25 × 40 meters. We need grounds for handball, basketball, badminton and volleyball. Please help us!" There is a lot of serious (and non-serious) work in the classroom. The students define their own tasks, they produce a lot, they calculate a lot.

A particular job is requested from 'Batman & Co'. This company needs bats for table tennis. The price must be no more than 89 Danish Kroner, and the Danish division of 'Run For Your Life' has no bats of that price in stock. However, a Swedish supplier is able to sell the bats at 70 Swedish Kroner. Naturally, the students also have to consider insurance and freight charges that are estimated to be 1.5 %. They are informed that the exchange rate between Danish and Swedish Kroner is 82.14; another source says 81.29. Duty is 8% and the profit is expected to be 25%. Finally, the VAT (Value Added Tax) in Denmark is 25%. As mentioned, 'Batman & Co' only wants to pay 89 Danish Kroner per bat. How to handle this situation? We will see how two students cope with this and how the teacher tries to facilitate their progress in work.

Mary and Adam from one of the groups get a computer and find a spreadsheet to solve the problem. They struggle hard and concentrate on this work during the two-hour lesson without any break.⁵⁹ A couple of times they are interrupted and challenged by the teacher. The 'factory hall' is filled with humming and shouting voices of the other 'workers',

⁵⁹ This is especially remarkable in the case of Adam, who is considered a problem child by many teachers. He has not done much during the first days of the project, but before today's lesson the math teacher, with whom he obviously has a respectful relationship, has kindly asked him to pull himself together and show his capability. The teacher has confidence in Adam, and his idea was to challenge him by bringing the computer into the classroom. See also Alrø, Skovsmose and Skånstrøm (2000).

but Mary and Adam do not allow themselves to be disturbed, not even when other group members try to interfere in what they are doing.⁶⁰ On this day the whole class is going on an excursion, and the bus will leave a few minutes after the lesson. But Mary and Adam keep working, and they do not stop when the teacher ends the lesson (in this school there is no bell ringing). They remain all alone in the room working at the spreadsheet.⁶¹

After some time they realise that they have to stop in order to join the others: Mary: "Well, should we give this up?" Adam: "Yes, no, we'll save it, won't we?" Mary: "Yes, it's actually very interesting, we have been quite clever, don't you think?" Leaving the classroom, Mary blushes when she addresses the teacher: "*Today we really learned something!*"

Prices in Danish Kroner

Mary and Adam have not been in a group together before, but they seem enthusiastic about what they are going to do. They start trying to set up a spreadsheet with the information from the teacher's introduction.⁶² They start with the cost price of one bat, $C1$, which is 70 Swedish Kroner. Then they add insurance and transport which is 1.5 % of the cost price. They construct the formula $C2 = C1 + 0.015C1$. Then follows the transaction into Danish Kroner. Mary clears her throat:

Mary: OK, then there's the rate of exchange if you are to work out what it is in Danish Kroner, right?

⁶⁰ Actually the surrounding voices disturb the tape recorder, so that it is difficult to hear what Mary and Adam say. That is one of the reasons for many incomprehensible utterances [ic] in the transcript.

⁶¹ We present and analyse the whole course, but in what follows some sequences of the transcript are omitted.

⁶² Mary and Adam are going to construct the following sequence of formulae (in principle):

$C1$ (the original price)

$C2 = C1 + 0.015C1$ (insurance and freight is added)

$C3 = 0.8129C2$ (transaction into Danish Kroner)

$C4 = C3 + 0.08C3$ (duty is added)

$C5 = C4 + 0.25C4$ (profit is added)

$C6 = C5 + 0.25C5$ (VAT is added)

Our numeration is a bit simplified compared to Mary and Adam's. The conversation is strongly indexically anchored which means that the situational context including the computer gives meaning to the large number of features like deixis, pointing, facial expressions etc. This meaning can (easily) be understood by the students in the situation, but it needs translation or explanation when presented in another context.



<http://www.springer.com/978-1-4020-0998-3>

Dialogue and Learning in Mathematics Education

Intention, Reflection, Critique

Alrø, H.; Skovsmose, O.

2002, VIII, 286 p., Hardcover

ISBN: 978-1-4020-0998-3